Research Paper

Deciding Where to Live in The Suburb:

Linking Utility-Maximization and Residential Mobility in Polycentric Urban Region Context

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Abstract

In a polycentric urban structure, the commuting pattern which was traditionally directed from the suburban to CBD, is becoming more complex with increasing reverse- and cross-commuting activities. This paper is aimed to provide empirical evidence which validating the importance of utility-maximizing parameters, derived from the monocentric model, in the context of post-suburbanized polycentric urban region. It questioning to which extent of different residential mobility between municipalities could be linked to the variation of such parameters. Focusing on the frontier areas of Jakarta Metropolitan Area (JMA), Indonesia, each municipality within the region is treated as a Decision-Making Unit which intend to maximizing co-location between residential and employment uses. Using the data from the 2017 National Socio-Economic Survey (SUSENAS), the analysis was simply taken by comparing the aggregative-mean of income, housing-cost and transportation cost data from each municipal in JMAs periphery. The Data Envelope Analysis (DEA) was used for measure how these utility-maximizing parameters related with inter-suburban migration flows. The results show that housing cost is the only utility which still has significant impact in polycentric setting. Moreover, the area with lowest utility value tends to be the most efficient in attracting in-migrant. It implies that residential mobility within suburban areas does not motivated by lower housing or transportation cost, nor to get near to major employment location. Thus, workers heterogeneity and behavioral aspect may have played bigger role in residential mobility of polycentric urban setting.

Keywords

residential mobility, polycentric, suburban, utility-maximization, Data Envelope Analysis

1. Introduction

Globalization has transformed what previously known as suburban into some new different urban forms. The decentralization of employment to suburb has created multiple attractive

sub-centers, where residential and economic activities were mixed together. This process, termed as post-suburbanization, could be found globally with some variation between countries (Phelps and Wu, 2011). In the United States, post-suburbanization mainly involving the decentralization of service, driven by private sectors (Fishman, 1987; Kling, Olin and Poster, 1995). In The Continental European region, the decentralization of service is strongly controlled by government's policy and planning (Bontje, 2004). In China, government control become the most prominent trait, especially on manufacturing sectors de-concentration from its main metropolis (Wu and Phelps, 2008). In Indonesia, economic decentralization was largely occurred in manufacturing sectors, marked by the establishment of several industrial complexes (Hudalah and Firman, 2012). Lack of government control has been used by private sectors to took the control of new independent settlement development outside the urban core to support the industrial complex, creating post-suburbia (Firman and Fahmi, 2017). Post-suburbanization could be used to explain the variety of urban transformation process in global metropolitan periphery. Nevertheless, distinguishing feature between different regional outcome, may laid on how variety economics base and institutional background affected their urban development.

Different post-suburbanization pattern would create differ urban forms and population consequences. In the United States, declining suburban out-commuting has been followed by the decrease on its population (Lucy and Phillips, 1997). Increasing suburban economies has stimulate inter-suburban commuting dominance (Lee, Seo and Webster, 2006). In Continental Europe, post-suburbanization marked by balanced core to suburban migration (Tzaninis and Boterman, 2018) and high non-urban population growth (Champion, 2001). Post-suburbia served as a reverse and cross-commuting destination, while many suburbanites still made traditional commuting to the urban core (Bontje, 2004). In China, the liberalization in housing market has encouraging the middle class to relocate to the periphery, as well as increasing long distance traditional commuting volume (Zhao, Lü and de Roo, 2010; Hu, Sun and Wang, 2018). In Indonesia, peripheral urban transformation was reflected in the massive growth of urban localities in the outskirt, and the rise of reverse-commuting volume (Firman, 2011). The existence of some new sub-center has attracted industrial workers from adjacent municipal area (Permatasari and Hudalah, 2013). Nevertheless, recent evidence in Jakarta Metropolitan Area has shown that the growing metropolitan transportation problems was not only involving reverse-, but also cross-commuting problems (Sadewo and Syabri, 2018). The emergence of post-suburbanization and its polycentric spatial structure has been argued to have double spatial implications: changes in commuting patterns and population mixing.

To some degrees, the commuting pattern is particularly affected by the individual residential strategies (Baccaïni, 1997). The evidence from Catalonia, Spain, has shown that commuting decision influenced the migration decision, vice versa (Romaní, Suriñach and Artiís, 2003). The suburbanization of employment to peripheral areas could bring positive impact to travel distances, if the workers choose to reside close to their job location (Ingram, 1998). The emergence of complex commuting phenomenon is showing that employment suburbanization process, did not followed by workers residential adjustment. The experience from French has indicate that majority suburban jobs has been taken by the workers from another suburbs (Aguiléra, 2005). While the motivation for doing reverse commuting could be explained by amenities-related factors (Aguiléra, Wenglenski and Proulhac, 2009), or socio economic disparity between home and work location (Davidson and Ryerson, 2018), the existence of cross-commuting pattern have not been well comprehended. While several

attempt has linked cross-commuting to household characteristics (Tscharaktschiew and Hirte, 2010), many were still presumed utility-maximization related factors as a major cause of the phenomenon (Berliant and Tabuchi, 2015; Viguié, 2015; Wrede, 2015). Despite of indicating the monocentric model influences, to the best of our knowledge, no empirical evidence of utility maximization influences on the residential mobility within the polycentric urban settings has been provided. Thus, question arises whether utility-maximization factors was also involved in a residential adjustment problem within polycentric urban region?

This study took the case study of Jakarta Metropolitan Area (JMA), a vast growing polycentric urban region in Indonesia. Post-suburbanization has been evident on its eight peripheral municipal areas. Driven by the private sectors, the development in the suburbs has been growing fast in the last several decades. Phelps and Wood (2011) argued that general post-suburbanization process would lead to the formation of a new town, as it was also expected by Hudalah and Firman (2012) in the case of JMA. Yet, recent evidence shows that amplifying polycentric form of JMA peripheral areas is dominated by manufacturing sectors, pushing back retail and service to agglomerate in the urban core (Sadewo, Syabri and Pradono, 2018). To date, the spatial implication of such distinct process to the population mobility have not been comprehend well. Despite the polycentric spatial structure being an important feature in the post-suburbanization process, several evidences from the post-suburbanized region, especially in Asia, still indicate a tendency toward monocentric land value pattern (Tsutsumi, Shimada and Murakami, 2011; Fang, Logan and Pal, 2015; Elmanisa *et al.*, 2016). Therefore, an empirical evidence of the interplay between utility-maximization and residential mobility in the region would not only contribute to the urban economics debate, but also to the post-suburbanization discussion.

2. Literature Review

2.1. *Urban Structure and Residential mobility*

The terms of residential mobility denote as an intra-urban moves within the same region, typically in a relative short distance (Howley, 2009). In a monocentric urban model, residential location selection was determined from one's ability to make a trade-off between land rent and transportation cost. The workers live in a concentric ring of a particular distance from the central business district (CBD) forming distance decay pattern of residential density. Given the assumption of perfect information, zero transaction cost, and zero moving cost, the residential location consumption for every household is frictionless and static. Quigley and Weinberg (1977) argue that in the equilibrium state of monocentric model, no household has an incentive to move, unless there are some changes in the parameter which defines their utility-maximizing behavior: housing prices; income or other demand determinants; and transportation cost. However, when employment is decentralized within the monocentric city, Dubin (1991) suggests that workers should adjust their residential location closer to their job to minimizing commuting cost. However, many evidences show that pure form of monocentric model has been increasingly difficult to find throughout the world. The emergence of multiple urban subcenter creates more complexity on worker's residential location selection.

Theoretical residential selection discussion in a multi-centered urban economics framework were built upon utility-maximization consideration. Using an inter-connected two cities

setting, Suh (1988) derived several scenarios of equilibrium with intercity commuting. The distance between cities, urban size, cost of moving, commuting cost, and the wage difference, were identified as important heterogeneities for generate the intercity commuting. Depending on the location of CBD, in a decentralized employment, wage rate is crucial to determine workers residential location (White, 1988). Wrede (2015) proposed three probabilistic properties of urban equilibrium. First, workers residential segregation of different subcenter is theoretically incomplete, thus, generates substantial excess commuting. Secondly, land rents are generally asymmetric around subcenters. And third, only a fraction of the available land in the outer urban areas were utilized, whereas the land rent is already equal to the land opportunity costs and therefor it is invariant with the distance to the CBD. When a commuting subsidy is given, it could create a welfare enhancing transfers which stimulate the decision of moving or commuting (Borck and Wrede, 2009). A further contribution was made by Viguié (2015), by adding the moving cost and housing-search imperfection variables in the canonical urban economics model, which lead to the coexistence of people working in different employment centers. Shortly, the basic assumption of distance decay housing price gradient from the monocentric model were still confirmed in the multi-nodal version.

The evidence from the several polycentric urban regions have also showing some consistency with the classic urban bid-rent theories. The existence of multi urban center is found to have a significant impact on housing prices both in developed and developing countries context (Heikkila *et al.*, 1989; Wen and Tao, 2015). Yet, each center shows different effect on housing prices, whereas new CBD has a higher impact than the traditional ones. Other studies using the multi-centered framework in Glasgow by Osland and Pryce (2012) found that the relationship between housing price and employment center in is non-monotonic. It is tended to rise initially to some distance from the employment (sub) center, and then gradually decline. With respect to commuting activities, more attractive employment (sub)center seems to played substantial role on affecting housing price gradient. Using a bi-centric examples, the study of Yiu and Tam (2007) find that the a closer location to more frequently traveled employment center have relatively higher housing prices. Huge amount of commuting activities between two similar employment centers would flatten housing price gradient from one to another, vice versa (Yiu, 2008). In San Francisco, the displacement between job-housing location is influenced by such high housing prices around employment centers (Cervero and Wu, 1997). Nevertheless, high waged workers in the outlying centers does not seems to follows the rule, as they choose nearest housing with high price. With respect to transportation cost, the study from 28 metropolitan areas in the US have shown that in many areas, transportation cost is as high or higher as housing, whereas low-income household tend to live in such high transportation cost areas (Haas *et al.*, 2006). Hence, the finding is also confirmed the influence of workers financial capacity which reflected on wage rate in determining the residential location selection.

2.2. Urban Development and Mobility in Indonesia

As commonly found in other developing countries, land development has been the subject of one of the main problems for many urbanites. While reviewing urban land development policy in developing countries, Firman (2004a) described some of the recognized problems: including the use of land resources; land regulation and legal frameworks; institutional land management and coordination; land pricing and taxation; inadequate data, information, and infrastructure capacity; and the lack of tenure security. In Jakarta Metropolitan Area, such

land policy perplexity has escalating land-price in the CBD and land banking practice by private sectors in the outskirts (Firman, 2004a, 2004b; Elmanisa *et al.*, 2016; Firman and Fahmi, 2017). Several consequences emerge in the peripheral areas. New town development has created spatial segregation and the rising tension between land owners, developers, and the local government (Firman, 2004b). Indeed, the housing expenditure in Indonesia were found to be strongly with income (Monkkonen, 2013). Thus, the mismatch between housing supply and demand in the peripheral areas has put a bigger challenge to the social segregation problems (Cahyadi and Surtiari, 2016).

Jakarta's future has argued to accommodate the middle class, while decreasing of affordable housing has displaced the marginalized farther on the outer periphery (Kusno, 2012). The influence of the urban structure transformation in JMA was showed by the increase of average number of daily trips and trips length in JMA between 1985 and 2000 (Susilo *et al.*, 2007). In terms of mobility, the segregation is clearly visible from the commuting mode preference. Earlier study from Sugiarto *et al* (2014) in JMA have shown that there is some tendency where increasing income followed by the rise in their transportation cost. Nevertheless, different from most developed country, up to 56 percent of commuting travel in region is conducted by motorcycle (Sadewo and Syabri, 2018). While the automobile commuters growth have been stagnant between 2000-2010, the use of motorcycle has increased of 27,5 percent (Susantono, Santosa and Budiyono, 2011). Among many reason, recent evidence from the college student travel in Semarang, Indonesia have revealed that motorcycle travel cost only half than public transportation (Nasruddin and Ratnasari, 2014). The rapid use of motorcycle to facilitate transportation cost-maximization seems to have encourage many people to commuting.

3. Data and Method

This study compares utility-maximizing parameters value between those eight suburban municipalities. Recently, Dewita *et al* (2018) have been highlighted the limited availability of publicly available and accessible data on housing costs, transport costs, and household income. Here, the value was obtained by analyzing the data from the National Socio-Economic Survey (SUSENAS). It is one of the most reliable cost of living survey in Indonesia, and have been used by several studies of housing (Monkkonen, 2013). The SUSENAS was a household expenditure-based survey. Unlike other surveys in Indonesia, it includes housing and transportation expenditure along with income and recent migration experience. The survey held twice a year in March and September, whereas the former intended for municipal level estimation needs, while the later used only for provincial level estimation. The March 2017's SUSENAS consist of 12,694 household in the whole JMA, of which 7,869 household located in the suburb is used for the modelling purpose.

For measuring household income, total monthly household expenditure was used for proxy by assuming of zero saving. The housing cost (HC) was approached using monthly residential expenditure, distinguished by type of tenure: tenured housing (TH) and rented housing (RH). While the rented housing cost shows actual paid price, the tenured housing cost is an owner equivalent rent (OER) for their current house, in which they willing to pay in a competitive market. Similar concept has also been used by US Bureau of Labor Statistics to measure Consumer Price Index. It was more efficient to measure user cost directly, thus preferably both theoretical and empirical (Gillingham, 1983). There had been some concern of several

drawbacks when using OER as a housing-cost proxy. Díaz and Luengo-Prado (2008) have been highlighted the possible bias of OER with the actual cost of housing, mainly comes from tax advantages from housing service. Dewita et al (2018) have also emphasize of the hardship for the respondent to accurately provide the estimation. Yet, they added that it is more suitable in Indonesian context for providing “aggregated and ground-truthed” information.

The differences of residential expenditure between municipal could also depict the moving cost, as it describes the potential amount that would be gained/loss if one’s decided to move. While the transportation cost (TC) comprises of total monthly expenditure for the use of private vehicle and public transportation by all household member, including fare, fuel, taxes, maintenance, parking, and other operational cost excluding the purchase. The monetary aspect reported in this paper was obtained on the similar manner with Dewita et al (2018). Finally, the residential mobility refers to the number of households who made a residential move among the suburban areas within the region in the last five years (recent migration). The household who move within the same municipalities, or move from TH to RH vice versa did not covered by this paper.

The analysis was simply taken by comparing the aggregative-mean of income, housing cost and transportation cost data from each municipal in JMA. Owing to the use of municipal level areas as an analysis unit, the spatial insight was given by divided the region into four concentric rings, based on their distance to the CBD. The core areas consist of the CBD (0-5 Km) and the core-ring (5-20 Km), while the suburb consist of the inner urban (20-30 Km), and the outer urban areas (30-60 Km). Furthermore, Data Envelope Analysis (DEA) was used for measure how these utility-maximizing parameters relate with in- and out- migration flows on suburban areas. DEA is a non-parametric based method, which originally designed to measuring the relative efficiency between units who performing similar task. It offers more objective ways for ranks the units itself in a best way without have any prior information of data distribution, nor the weight of each variables. In the calculation, each municipal in the JMA peripheral areas was treated as Decision Making Unit (DMU) which maximizing employment for their own citizen. Thus, they should provide a competitive environment to attract residential movement, rather than commuters. Given of particular input and output, DMU with the best combination (score of 1.00) were chosen as the most efficient location in doing the task, relative to other.

4. Findings

The comparative housing cost (HC) for the whole JMA shows some congruity with distance decay pattern (Figure 1.a). Highest HC was found in Central Jakarta, where the CBD (metropolitan core) located. It was decreased from 12 to 48 percent for tenured housing, and 28 to 55 percent for RH in the core-ring. The HC increased again in the inner urban areas, especially in the east and western parts of the inner urban areas. The HC tends to decrease as it goes further to the outer urban areas, except for rented housing (RH) in Bekasi Regency, where the recognized post-suburbia lies (Hudalah and Firman, 2012). The overall cost of having a tenured housing (TH) in JMA is 28 to 29 percent less than RH. This value was at the same rate between core areas and the suburb. Nevertheless, having whether TH or RH in the core areas will cost the workers doubled rather than in the suburb. Furthermore, moving from the inner- to outer-urban areas means that worker could save almost 33 percent from its HC spending if they choose to made a TH, and only 12 percent if they choose to rent.

For the transportation cost (TC) aspect, different pattern was found in the core-ring areas. While there was a tendency of decreasing TC for those who have RH, the TH travelers experienced the opposite. Their TC was increasing from 17 to 50 percent. Increasing TC cost was also found in several suburban areas, most notably showed on South Tangerang in the inner urban. South Tangerang's citizen TC was the highest compared to whole JMA areas, both for TH and RH. Their Adjacent neighbor's Depok was ranked the second, and overall inner urban ring TC was 14 percent higher than the regional's average. In contrast with the HC, the TC for permanent tenure was 38 percent higher than for those who rent. Living in core areas would cost TC respectively 11 and 5 percent higher for each TH and RH compared to the core area. Shall the workers choose to move farther from inner- to outer-urban areas, they could have saves 45 percent for TH and 32 percent for RH.

Average JMA household's income in 2017 was 6.2 million Rupiah. Those who live in the suburb have 23 percent less income compared to the core areas households. Figure 1.b. shows that while the municipalities with highest income could be found in South Tangerang, an inner-urban area, municipalities with lowest average income lays within the west and southern parts of the outer-urban. The disparity was even higher when we distinguished between TH and RH. Overall renters in JMA has 37 percent less of income compared to those who have tenured. Interestingly, RH household in the inner-urban areas have a higher income, compared to TH household in core, and RH household in core areas. If this finding be seen together with TC pattern, it could show that RH household have their income by commuting to another municipalities. Thus, the income aspects on selected residential location seems to be more related with TC rather than HC.

Figure 1. Some Comparison of Utility Value in JMA

Inter-suburban moving events in JMA was actually inconsiderable. In 2017 the number of intra-suburban migrating household was less than 1.6 percent from the total. Highest in-migrant was found in Bogor Regency, municipalities which has the lowest HC and income. Migrant in this municipality mainly came from their adjacent inner-urban such as Depok, but many also came from another outer-urban areas like Bogor City, and Tangerang Regency. On a contrary, the in-migration flows seem to be reversing in Bekasi city. Located in the Inner-urban areas and being the second place of in-migration location, the majority of its migrant is

coming from the neighboring outer-urban, especially Bekasi Regency. The situation reciprocally experienced by Bekasi Regency. Almost 76 percent of Bekasi Regency's movers choosing Bekasi City in the inner urban areas, whereas 70 percent of the numbers, is moving for a TH. Such massive flows made Bekasi Regency the highest out-migrant holder. In brief, either in- or out-migration in JMA suburban seems to have no particular pattern.

For DEA analysis, recent migration experience between suburban areas was set as an output. The result showed a confirmation of how each TH cost, RH cost, TC, the combination of transport and housing cost (T+H cost), and income were efficient to attracted in-migration to Bogor Regency (Table 2.a). On the other hand, RH cost and T+H cost was showed a strong influence to pushing households moves out from Bogor Regency (Table 2.b). Considering that only 18 percent of the housing is rented, it means that most of out-migrant is renters and they moved for better opportunity in others suburb. The migrant which came to Bogor Regency pays as same as the average of existing household for TH cost and TC, but must pay one-third higher for RH. Similar situation of housing renters could also find in Tangerang Regency. The household moving to this place has a below average income and TH, but must pay tripled from the existing household. Interestingly, Bekasi Regency which was a major employment location was placed in the top rank for pushing people's moving out. The fact that the majority of their out-migrant move to a costly place in inner-urban areas indicate that utility-maximization was not the main reason behind this decision. The movers to Bekasi City have an average for income and HC, but pays 41 percent higher for TC indicates that they did not move closer to their job and hence creating more commuting. Other municipalities utility characteristics was far from ideal to attract inter-suburban migration. Thus, this municipal will continue to be the destination of movers from other suburban.

Figure 2. The Relation of Utility Parameters and Migration in JMA's Suburban

5. Conclusion

This paper comes with two conclusions. First, monocentric model utility-maximization parameters, were still consistent to be used in polycentric setting, but limited only for HC. For TC, inner-urbanites tend to have the highest expenses, imply that they have the longest journey, or maybe they were the most severely exposed with congestion. While less average TC in outer-urban areas shows that they were co-located better. In polycentric structure, the

trade-off between HC and TC does not merely depend on location. Tenorial status was also playing an important role on residential location decision. Despite of having much lower income, household which decide to choose RH were burdened with high HC cost but relatively lower TC. On contrary, selecting TH would cost less for housing, but charge more on TC. Secondly, suburban municipal with lowest utility value like Bogor Regency tends to be most efficient in attracting in-migrant. Surprisingly, they also produce some high score on pushing migrants out. Meanwhile location with similar utility value such as Bogor City does not display the same manner. Instead, developing post-suburbia, a significant major employment location as it could find in Bekasi Regency creating a numerous out-migration flows to their inner-urban area. This phenomenon shows that residential mobility within suburban areas occurs not for a lower HC and TC, nor to get near to major employment location. Further research on urban mobility within a polycentric setting should move beyond utility-maximization approach, and tried to identify the heterogeneity and behavioral aspect of mobile workers.

6. References

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