MASTER'S THESIS REAL ESTATE STUDIES

THE HOUSING PREFERENCES OF WORKERS IN JAKARTA

Muhammad Hidayat Isa

S4326458

FACULTY OF SPATIAL SCIENCES

2021

COLOFON

Title	The housing preferences of workers in Jakarta
Version	Final draft
Date	June 28, 2021

Author	Muhammad Hidayat Isa
Student number	S4326458
E-mail RUG	m.h.isa@student.rug.nl
E-mail private	dayatmhi@gmail.com
Supervisor	prof. dr. E.F. (Ed) Nozeman
Assessor	dr. M.N (Michiel) Daams

ABSTRACT

Jakarta is facing a mismatch in housing supply and demand. One of the reasons is due to a qualitative mismatch between the supply of houses by developers and demand from middle to low-income workers. This condition leads to vacant dwellings in several affordable housing projects. This study aims to analyze the housing preference of workers in Jakarta. Six housing attributes, comprising tenure option, housing cost, dwelling type and size, distance to public transportation, and shops, are examined. Using a rating-based conjoint experiment, 16 housing profiles were constructed from the attributes and their levels, and a digital survey was delivered to respondents in Jakarta. The experiment was analyzed further using ordinary least squared (OLS) to estimate the contributions of the attributes and attribute levels. A segment-based model and cluster analysis (K-means clustering) are also delivered in the analysis to examine the heterogeneity of the preference between income levels. The results show that workers in Jakarta consider distance to public transportation and housing cost the most and compensate (tradeoff) with the other attributes. These preferences differ between income groups. The most important attributes for low-income workers are distance to public transportation and housing cost, while the distance to public transportation and dwelling size are the most important for middle-income workers. In addition, cluster analysis indicates that the heterogeneity of housing preference is not only driven by income category but also by some other factors such as type of household and mobility habit. The cluster analysis also provides bundles of housing characteristics that are preferred by the workers. This study contributes to existing empirical literature in analyzing housing preferences in Jakarta and may be of interest to developers and policymakers.

Keywords: Housing preferences, conjoint experiment, cluster analysis

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Motivation

Jakarta is facing a mismatch between housing supply and demand (Nasution, 2019). The demand for affordable houses is high, however, few housing developers supply affordable houses to the market (Nasution, 2019; Nabila, 2019). Even when available, most of these houses do not meet their potential consumers' expectations regarding price, quality, and accessibility (Sugianto, 2019; Okezone, 2019). Formal middle to low-income workers in Jakarta are the ones that affected the most. The government facilitates these workers with a housing finance liquidity facility (FLPP), a housing loan subsidy that is eligible for a worker with a salary ceiling up to Rp 8 million (about USD550) (Iswara, 2020). This facility eases formal workers to become the first-time homeowner.

To accommodate the demand for affordable housing, the government launched the National's One-million House Program in 2015. As an integral part of this program, Perumnas - a state-owned enterprise, developed six affordable house projects in Jakarta and vicinities. However, 44% of these houses have not been sold and became vacant (Perumnas, 2020). To achieve the aim of the One-million House Program, it is essential to understand the considerations of Jakarta's workers in choosing their first house to own. This research focuses on determining the housing preferences of Jakarta workers who are eligible for housing finance liquidity facility (FLPP).

1.2 Literature review

Housing preferences have been extensively discussed over the last few decades. Various housing attributes that play a crucial role in influencing people's preferences and housing decisions have been mentioned. These attributes are both intrinsic attributes (for example, cost and size) and extrinsic attributes (for example, exterior design and space), neighborhood, and other locational factors (Opoku and Muhmin, 2010). One of the reasons for the diversity in results is that the housing attributes vary across locations and social contexts (Opoku and Muhmin, 2010). Consequently, the study's findings are more difficult to generalize, and more research into housing preferences and choices in specific locations is necessary (Jansen et al., 2011).

Changes in the housing market and shifts in demographic, socio-economic, and socio-cultural conditions in certain locations influence housing preferences and housing behavior (Jansen et al., 2011). For example, Colom and Moles (2008) find that in Spain, households' behavior pattern with respect to housing choice has shown fundamental variations in response to changing social and demographic factors. In 2000, people with older age and higher

educational level favored the choice of large dwellings. However, in 1990, age and education determined housing tenure, regardless of size. In a country with significant low-income consumers and shifting culture like Saudi Arabia, where people start to consider living independently instead of with the extended family, the preferences of housing attributes are also different. Opoku and Muhmin (2010) find that in terms of dwelling types, the majority prefer a small house to a duplex or apartment. In terms of tenure options, despite their limited incomes, the majority prefer buying over renting. In China, which shows a rising share of middle-income workers and greater freedom in housing choice, Wang and Li (2004) find that extrinsic attributes like neighborhood conditions and access to public transport dominate the preferred choices. General behavior, especially in deciding to become a first-time homeowner, is influenced by a household event such as cohabitation and marriage (Mulder and Wagner, 1998; Smith and Mulder 2008). The decision also depends on household members' preferences, level of education, and working status and duration. Despite many differences, some attributes are frequently mentioned in previous studies that influence people's housing preferences, such as size, dwelling type, tenure options, neighborhood conditions, and accessibility.

Previous studies that focus on determining the housing preferences among workers also found similar attributes that influence their preferences. Tomaney and Bradley (2007) address the housing and residential preferences of mobile professional and creative workers in Tees Valley, England. Their research shows that housing size, security, amenity, and road accessibility were the attributes preferred by these knowledge workers. Bontje (2016) analyzed the residential preference of creative workers and their housing situation in Shenzhen. His study indicates that housing price, environment (proximity to amenities), and location (distance to the workplace) are housing attributes that are mentioned often. Accessibility to transportation and neighborhood conditions are also mentioned but less frequently. Dol and Boumeester (2018) study the relationship between homeownership and flexible labor at the household level in the Netherlands. The results show that in terms of tenure options, flex workers on temporary/zero-hour contracts have smaller chances of moving into homeownership than those on permanent contracts. They also tend to express less preference for homeownership. In these specific studies, additional housing attributes such as price, location, and amenities are also mentioned as influential to workers along with size, dwelling type, tenure options, neighborhood condition, and accessibility.

Housing preferences in Indonesia have not been extensively studied or published. Few studies about housing preferences in Jakarta are available, and none of them focuses on workers'

housing preferences[1]. Farasa and Kusuma (2018) explore the housing attributes preferred by young adults in Indonesia. According to their research using content analysis, green area and view, location, simplicity, home design, and accessibility are all important aspects of housing attributes in Indonesia. Forementioned study, however, does not mention specifically the region in which the research was conducted. Sihombing et al. (2019) discuss housing preferences of low-income households in Jakarta. Their study only focuses on the living spaces' attributes (number of bedrooms, bathrooms, living room, etc.) and how these preferences change over their life-cycle, especially in their early housing career. Their study examines that changes of living space preference significantly affect the period of the house occupation changes, occupation status changes, marital status changes, and ownership status changes. However, other housing attributes are not discussed in that study.

To conclude: at this moment, no empirical literature has been found that analyzes housing preferences of workers in Jakarta. Doing such research will fill the gap of this specific topic in the literature.

1.3 Aim and research questions

The research aim of this study is to analyze the housing preferences of workers in Jakarta. Therefore, the main research question of this thesis is: which housing attributes determine the housing preferences of workers in Jakarta?

Sub-questions

1) Which factors influence housing preferences and choice behavior according to existing literature?
2) What is the relative importance of different attributes that determine the housing preferences of workers in Jakarta based on own empirical research?
3) How does the importance of preferred housing attributes vary between low- and middle-income workers in Jakarta?

1.4 Data and Methodology

Sub question one will be explored by doing academic literature research. This literature research will reveal different factors that may influence housing preferences and choices. These factors then will be specified according to workers' behavior.

Sub question two and three will be examined using a conjoint experiment (rating-based conjoint), a stated preference method to measure preferences quantitatively. In this

[1] The author used keyword “housing preference Jakarta” in Scopus, Google scholar, and SmartCat of University of Groningen.

experiment, respondents are asked to evaluate alternatives described by a combination of attributes with varying values (Jansen et al., 2011). This experiment will be conducted through an online survey. A standardized digital questionnaire to evaluate alternatives will be distributed to several workers' WhatsApp groups in Jakarta, a common platform to share information among workers (Vukic et al., 2015 and Sulistyawati et al., 2020).

After obtaining the data, to answer sub-question two, ordinary least square (OLS) regression will be used to analyze the utility value given by the respondent. The OLS model represents the preferences of overall utility attached to the alternatives and part-worth utility contribution of attributes to the overall utility of alternatives (Jansen et al., 2011). The estimated part-worth utilities indicate the preference to the particular attribute level.

In addition, to answer sub-question three, we will examine the heterogeneity of the conjoint result by implementing segment-based models and cluster analysis. To explore the preference differences, the conjoint analysis will be analyzed separately among each subgroup. The subgroups will be based on income groups. A respondent with a maximum income of Rp5 million/ month (about USD344/ month) is considered low income and a respondent with a range of more than Rp5 million/ month until Rp8 million/ month (about USD550/ month) is considered middle income. The low-income range is based on workers' minimum wage in the Jakarta Metropolitan Area in 2021, which varies between Rp4.2 million/ month (about USD289/ month) to Rp4.8 million/ month (about USD330/ month) (Idris, 2021). The minimum wage is rounded up to Rp5 million/ month for this study to simplify the range. Further cluster analysis using K-means cluster will be used to investigate the other socio-demographic factors that may influence the different preferences. This analysis also provides bundles of characteristics of houses that are preferred by the workers and may be of interest to developers.

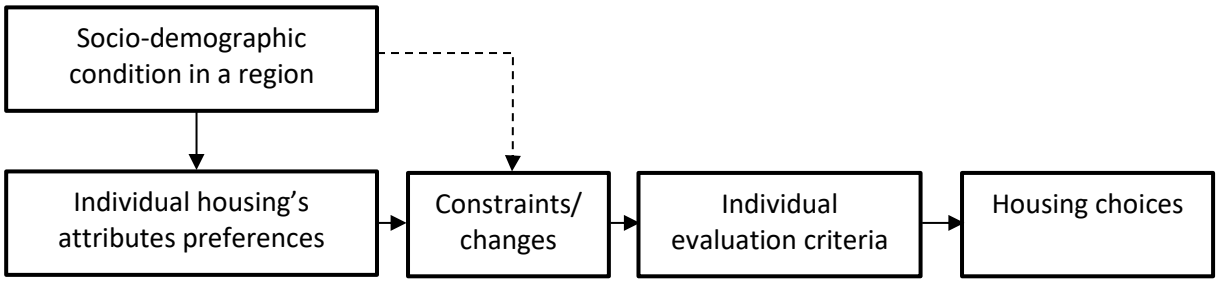


Figure 1. A conceptual model explaining housing preferences and choices

1.5 Outline

The remainder of this paper is structured as follows. Section two provides theoretical background and hypotheses related to factors/ attributes that influence housing preferences and choice behavior. Section three will discuss more in detail data and methodology. The

research's findings are discussed in the fourth section. At last, section five presents the conclusion, discussion, and recommendations.

2. THEORY

2.1 Housing preferences and housing choice

Housing preference and choice are two distinct concepts that are often confused in housing research. Preference is an expression of attractiveness and may guide choice and actual behavior (Jansen et al., 2011). However, the evaluation of preference does not imply that a decision must be made. Therefore, according to Jansen et al. (2011), preference is a relatively unrestricted assessment of attractiveness and might not show a strong relationship to the actual housing choice decision.

One of the reasons to study housing preferences is to improve the match between housing supply and demand (Coolen and Jansen, 2012). A qualitative mismatch between supply and demand could result in dissatisfied inhabitants and lead to vacant dwellings, both in the current stock and newly constructed housing. Measuring preferences can also improve communication since knowing consumers' housing preferences can improve communication between suppliers and consumers to more effectively target potential customers.

On the other hand, choices are presumed to reflect the joint influences of preferences (Molin et al., 1996). The choice for a particular dwelling with its multiple attributes is influenced by household needs and preferences, resources and restrictions, and housing market opportunities and constraints (van Ham, 2012a). The choice set is widened by factors such as resources represented by income and opportunities represented by the availability of suitable housing. On the contrary, restrictions such as having to live close to work and constraints such as a lack of funds and the affordability of homes limit the number of the choice set. These factors influence housing choice and make households tradeoff various dwelling attributes when making choices. As a result, the revealed preferences (the preferences are inferred from the actual choice) often differ substantially from their stated preferences (original preferences based on real or hypothetical houses) (Timmermans et al., 1994 and Coolen and Jansen, 2012).

To conclude, preferences as an expression of attractiveness play an essential role in the choice-making process. When an individual wants to make a complex decision, multiple attributes are considered to be evaluated. Some individuals have broad and limited choice sets due to different factors such as resources and constraints. Therefore, each individual tries to maximize the level of utility from each attribute so that the overall utility can be maximized. This actual choice is a tradeoff between relevant factors that affect individual choice. As a result, different attributes have a different level of importance for each individual.

2.2 Housing behavior and housing choice

Most households have limited options, and the house they live in is the result of some degree of choice within a limited choice set (van Ham, 2012a). However, given the limited choice set available, this dwelling could be the best they can get at a given point in their course of life. Rossi (1995) explains residential mobility and the association with housing choice. Residential mobility is the process of matching a household's housing needs to the housing options available (Clark, 2012). Rossi clarifies that different phases of life are associated with varying preferences of housing. He connects housing needs and preferences to the family life cycle, putting demographics at the center of understanding housing behavior (van Ham, 2012a).

The family life-cycle model introduced by Rossi (1955) and its more recent adaptation, the life-course model, are important models to explain housing behavior and choice (Jansen et al., 2011). According to the life cycle model, different stages of a family formation such as marriage, the birth of children, children moving out, and divorce or death of spouse result in changes in household size and composition, as well as in changing residential preferences and needs. The transition of the family's life cycle stages results in the need for more or less space. This condition may lead to a mismatch and dissatisfaction with current housing characteristics or attributes. For example, the number of bedrooms may no longer meet the family's needs or preferences after the first child's birth. When the space requirements of households do not hold, they will make decisions about what type of housing they want to choose and where to move.

According to van Ham (2012a), the life cycle model suggests a linear progression through a series of stages that are primarily determined by the size of the family unit and the household's age. Despite its influence, the life-cycle principle has been widely criticized for being too normative and deterministic. Society has changed dramatically in the past decades, and a variety of alternative life paths has emerged, such as remaining single, childless, divorce, and remarriage. These changes have an impact on housing behavior, and the choices members of households make. Therefore, in the 1990s, the life-cycle approach has steadily been overtaken by the life-course approach, a more flexible, comprehensive, and powerful method for analyzing housing behavior (van Ham, 2012a).

The life-course model examines the sequence of position of a particular person or group in the course of time (Jansen et al., 2011). An example of the sequence of positions in a life-course concept can be marriage status, parenthood, employment, etc. The frequencies of changes in positions over time are referred to as events or transitions. The sequence of events is classified as careers such as finding work, finding a partner, becoming a parent, etc. (Kok, 2007). In housing choice decisions, four life-course careers may explain moves: the educational career,

the labor career, the family career, and the housing or residential career (Jansen et al., 2011). Changes in each life-course career may change an individual or household's housing needs and preferences and influence the probability of moving. These careers can also influence housing choices. For example, having financial resources is a direct result of employment, and people in this stage may have a wider choice set. However, the housing choice is limited to be near a job location, and the likelihood of owning a house near a job location is low because house prices tend to be higher where there are concentrations of jobs (van Ham, 2012b). Therefore, these life-course careers could also interact with demographic, economic, institutional, and social conditions that could eventually influence housing choice (Kok, 2007).

In a life-course approach, households could also make transitions from owner-occupied to rental housing under certain circumstances. The main motive is a reduction in resources, a factor that is related to financial stability (van Ham, 2012a). Drop in resources may influence financial stability (an important precondition to homeownership) and lower the availability of credit (an institutional barrier to homeownership), affecting the tenure choice of an individual or household. A decline in financial resources often occurs as a result of losing a job and separation or divorce. A second motivation is a decrease in household size due to divorce, partner's death, or children leaving the parental home. These changes influence the need for smaller living space, and rental housing is typically smaller than owner-occupied dwellings, making it more suitable for smaller households. Some other motives are related to the urgency of moves, unfamiliarity with the housing market following a long-distance (usually job-related) move, avoiding the responsibility of owning a home, and withdrawing equity and free up wealth locked in the dwelling (van Ham, 2012a).

To summarize, finding work and becoming an employee is part of the life-course career. This particular career may interact with other careers since, during working age, some people may also start to find a partner and start their family career and housing career. During this stage, some factors affecting choices such as resources, restrictions, opportunities, and constraints may interact with the economic, institutional, social, and demographic conditions and influence housing preference and choice of workers.

2.3 Housing preference and housing choice studies

Housing preference and choice have been extensively studied over the last few decades. This topic has been discussed from different theoretical perspectives, numerous disciplines, and various angles (Timmermans et al., 1994; Jansen et al., 2011). As such, many methods and approaches have emerged, leading to diverse results in housing preference and choice studies.

Different methods and approaches mean differences in collecting data and outcomes. Timmermans et al. (1994) study housing choice processes from revealed and stated preference approaches. Revealed preferences collect data based on observations of actual housing choices made by households in real markets (van Ham, 2012b; Zinas and Jusan, 2012). However, this approach does not often provide insight into the actual choice process because the dwelling a household chooses may not fulfill all its needs and preferences (van Ham, 2012a). Because in a real market, the choice is limited due to some constraints such as budget, availability of credit, etc. Therefore, given their circumstances and preferences, the majority of households continue to live in suboptimal housing.

In contrast, stated preferences collect data based on people's reactions to hypothetical houses (Timmermans et al., 1994). This approach observes people's preferences from survey questions. It focuses on the expressions of people's evaluations of houses (moving desires, wishes, and intentions) or original preferences without considering constraints. Therefore, this approach is ideal for determining real preferences. However, according to van Ham (2012a), real preferences and desires/wishes are difficult to measure because households frequently adjust their preferences to fit within a realistic choice set.

According to Coolen and Jansen (2012), although some approaches are distinct, they have some characteristics in common. First, all suggest that houses can be defined and evaluated in terms of a set of attributes, and each of these attributes typically has two or three sets of levels. Second, all suggest that individuals acquire some satisfaction from each attribute level, and this satisfaction is reflected in part-worth utility in some approaches. Third, all approaches suggest that individuals combine satisfaction for various attribute levels into an overall preference for housing, but the combination rule may vary.

Another reason housing preference and choice studies have diverse results is that housing attributes and levels differ depending on location and social background. (Opoku and Muhmin, 2010). Each specific location has a different economic, institutional, social, and demographic condition that affects individuals' housing preferences and choices. These conditions may also contribute to individuals' resources, restrictions, opportunities, and constraints which eventually affect their housing choice.

Despite many discrepancies, some attributes are frequently mentioned in previous studies that influence people's housing preferences. Van Ham (2012a) explains that a dwelling can be described by its various attributes such as tenure option, dwelling type, size, and location. Because dwellings are composite goods, there are bundles of characteristics in which each attribute cannot be chosen separately. Therefore, these dwelling attributes have some

characteristics that attach to them, such as the neighborhood, facilities, and access to jobs. Most individuals trade-off multiple housing attributes to find a dwelling that meets their crucial needs and preferences.

Some studies also include some housing attributes in common such as housing cost or price along with tenure option, dwelling type, size, and location, as important attributes that influence individuals' housing preferences. Molin et al. (1996) study housing preference using a stated choice experiment for new housing construction in Meerhoven, the Netherlands. Nine housing attributes with two to three levels are examined. The findings show that the part-worth utility level of tenure option, housing cost, location represented by distance to shopping center, and size represented by the number of bedrooms, size of living room, and backyard are significant. Owner-occupied houses are preferred to rental housing, residential utility decreases with increasing monthly housing cost, utility increases as the size increases, and utility increases with decreasing distance to a shopping center. The findings also show the relative importance of these nine attributes. The result shows that monthly housing cost is the most important attribute, equivalent to more than 30%, followed by size (number of bedrooms and size of living room), and tenure option with the relative importance of each attribute is 15%. Wang and Li (2004) examine the joint choice of neighborhood and dwelling in Beijing, China. Location attributes represented by accessibility and distance to markets are classified as belonging to neighborhood sub-category. In comparison, housing price and dwelling type are classified as belonging to dwellings sub-category. The findings show that neighborhood sub-category attributes that represent the location are the preferred choices to attributes in dwellings sub-category. Hoshino (2011) studies housing preference using a conjoint choice experiment in 3 out of 23 wards of the Tokyo metropolitan area. Ten housing attributes with two to four levels are examined. The findings, based on the standard logit model (the homogeneous preferences), show that housing cost represented by rent per month, dwelling type, size represented by area of living space, and location represented by walking and commuting time (walking time to the nearest station and commuting time by train) and distance to shops and parks are significant to residential choice behavior. The residential utility decreases with increasing housing rent per month, utility increases as the area of living space increases, utility decreases with increasing time to the nearest station and commuting time, and the variable for proximity to shops shows a higher score than that for the park. Table 1 shows the summary of housing attributes in determining housing preferences.

2.4 Influential housing attributes for workers

Finding work and being an employee are parts of life-course. This life stage often interacts with housing and family career. During their working age, some people are starting to find a new place suitable to their current condition (for example, being close to their job) or starting to find

a suitable house to start a family. These life-course factors are considered constraints, and financial resources, a direct result of becoming an employee, play a major role in influencing individuals' housing choices (Mulder and Hooimeijer, 1995).

One of the crucial choices in this life course is the tenure choice, whether to rent or become a homeowner. Mulder and Hooimeijer (1995) reveal several factors that influence tenure choice. Resource effects of income and wealth play a significant role, where lower-income groups or workers with uncertain income have smaller chances of moving into homeownership and less preference for homeownership (Robst et al., 1999 & Dol and Boumeester, 2018). Age, an indicator of wealth accumulation and a representation of commitment and settling down, is considered a significant factor that influences tenure choice (Mulder and Hooimeijer, 1995). Home-ownership implies a long-term financial obligation, and this commitment is presumably avoided by young people who are just starting their labor, housing, and household careers. The household state is also a significant factor that influences tenure choice. Compared to new couples and families with children, single households have the lowest odds of becoming homeowners (Robst et al., 1999 & Mulder and Hooimeijer, 1995). Mulder and Hooimeijer (1995) also find that dual-earner families have lower odds of buying than one-earner families. The uncertainty of the job location could be the reason since dual-earners have wider location constraints in deciding on (the location of) their home.

As mentioned previously, some housing attributes such as housing cost, tenure option, dwelling type, size, and location are commonly mentioned in influencing individuals' housing preferences. These housing attributes are also considered as influential factors of housing attributes for workers in their life-course. Timmermans et al. (1992) study the residential choice behavior of dual-earner households in the Netherlands using a decompositional joint choice model. Their study includes some common housing attributes such as dwelling type, housing cost per month, tenure option, size represented by number of bedrooms, and location. Except location attributes, all of these attributes are statistically significant to residential choice behavior. The model shows that respondents prefer detached and semi-detached houses compared to row houses and apartments, and owner-occupied houses are preferred to rental houses. The utility increases as costs per month decrease and the number of bedrooms increases. The authors also find that respondents with children prefer a larger number of bedrooms. Although not statistically significant, households with children prefer detached and semi-detached houses, and they also prefer owning a house.

Hoekman (2019) studies the housing preference of starters in the Randstad region, the Netherlands. The study uses conjoint analysis, and the result shows that common housing attributes such as housing cost, dwelling size, and distance to public transportation are found

to be significant. The findings also show that dwelling size and housing cost are the most important attributes for starters, with the relative importance of each attribute being 31.5% and 28%, respectively. The summary of housing attributes that affect individuals' including workers, determining their housing preferences can be found in Table 1.

Table 1. Summary of housing attributes that are significant in determining housing preferences

Housing attributes	Representation	Significant	Authors
Tenure option	Tenure (rent & own)	Yes	Molin et al. (1996)
	Tenure (rent & own)	Yes	Timmermans et al. (1992)
Housing cost/ price	Monthly cost (Nlg. 800, 1100, 1400)	Yes	Molin et al. (1996)
	Price (≤ ¥4,000/m^2; ¥4,000-5,000/m^2; ¥5,000-6,000/m^2; ≥ ¥6,000/m^2); ¥ = Chinese Yuan	Yes	Wang and Li (2004)
	Rent per month (¥60,000; ¥70,000; ¥75,000; ¥85,000); ¥ = Japanese Yen	Yes	Hoshino (2011)
	Cost per month (Fl 600, Fl 900, Fl 1200, Fl 1500)	Yes	Timmermans et al. (1992)
	Maximum amount of willingness to pay (<€700, €800, €900, >€1000)	Yes	Hoekman (2019)
Dwelling type	Types (detached house, apartment ≤ 4 floor, apartment ≥ 5 floor without lift, apartment ≥ 5 floor with lift)	No	Wang and Li (2004)
	Building class (condominium & apartment)	Yes	Hoshino (2011)
	Type of dwelling (detached, semi-detached, row house, apartment)	Yes	Timmermans et al. (1992)
Size	Number of bedroom (2, 3, 4)	Yes	Molin et al. (1996)
	Size of living room (20 m^2, 30 m^2, 40 m^2)	Yes	
	Depth of backyard (5 meters, 10 meters, 15 meters)	Yes	
	Area of living space (5*jo*, 6*jo*, 8*jo*, 10*jo*); 1*jo* = ±1.62 m^2	Yes	Hoshino (2011)
	Number of bedroom (2 & 4)	Yes	Timmermans et al. (1992)
	Dwelling size (<30 m^2, 50 m^2, 70 m^2, > 90 m^2)	Yes	Hoekman (2019)
Location	Distance to shopping center (outside district, central, in neighborhood)	Yes	Molin et al. (1996)
	Accessibility (high, reasonable, limited accessibility)	Yes	Wang and Li (2004)
	Living convenience (within 500 m, 500 m – 1 km, > 1 km)	Yes	

	Walking time to the nearest station (5 min, 10 min, 15 min, 20 min)	Yes	Hoshino (2011)
	Commuting time by train (10 min, 20 min, 30 min, 40 min)	Yes	
	Distance to shops (≤ 500 m & > 500 m)	Yes	
	Distance to parks (≤ 500 m & > 500 m)	Yes	
	Distance to public transportation (≤ 300 m & > 300 m)	No	Timmermans et al. (1992)
	Distance to grocery store (< 250 m, < 500 m, < 750 m, < 1 km)	No	Hoshino (2011)
	Distance to train station (< 1 km, < 3 km, < 5 km, < 7 km)	Yes	

2.5 Hypotheses

A qualitative mismatch of housing supply and demand may dissatisfy the prospective occupants or inhabitants. This situation could lead to vacant dwellings, both in newly constructed housing and the current stock (Coolen and Jansen, 2012). Therefore, studying workers' housing preferences may improve the match between the supply and demand in the Jakarta Metropolitan Area case.

As previously discussed, having financial resources is a direct result of employment. In general, individuals with a permanent resource of income increase the chances of moving into homeownership (Robst et al., 1999 & Dol and Boumeester, 2018). However, the housing choice of being an employee is usually restricted in location, especially to be near to his/her job location. The likelihood of owning a house in this location is low because house prices tend to be higher where there are concentrations of jobs (Van Ham, 2012b). This high price may lead these workers to trade off their desired housing characteristics. Instead of choosing to own an expensive apartment in a job concentration location in the city, they may decide to own a single-family house in a suburban area near public transportation to get better access to the job location. In addition, living in suburbia is linked to the monthly commuting costs. As a tradeoff living in suburbia with higher monthly costs to the working place, the employee may lower his/her monthly housing cost by trading off his/her desired size attributes. After all, the larger the floor area, the higher the price of the house and its monthly cost.

This discussion emphasizes that housing cost is the most relatively important attribute. When all these attributes are evaluated at once, the workers will trade off the other attributes, and the housing cost will be considered first. This notion is aligned with the reviewed literature by Molin et al. (1996) and Hoekman (2019) that show the housing cost is one of the most important

attributes in both studies. Therefore, according to the discussion and reviewed literature, the following general hypotheses can be formulated:

1. Workers optimize the housing cost and location to public transportation and compensate (trade off) that with tenure option, dwelling type, size, and distance to shops.

The previous discussion explains that resources (represented by income and wealth) and family career play a significant role in influencing individuals' housing choices, including for workers. Lower-income groups or workers with uncertain income have smaller chances of moving into homeownership (Robst et al., 1999 & Dol and Boumeester, 2018). At the same time, these workers with uncertain income are presumably workers who are just starting their labor and housing careers, which are frequently associated with single households that need a smaller house. According to Robst et al. (1999) and Mulder and Hooimeijer (1995), these single households have the lowest odds of becoming homeowners. In addition, middle-income workers who have longer working experience and higher income have bigger chances to become a homeowner. These workers are presumably starting their families and having children, and require larger space or bedrooms (Timmermans et al., 1992). Therefore, following the discussion, we hypothesize that:

2. Preferred housing attributes vary between low- and middle-income workers in Jakarta. Low-income individuals prefer rental houses with smaller floor areas, while middle-income individuals prefer owner-occupied houses with larger floor areas.

3. DATA & METHOD

3.1 Overview of Jakarta and the housing conditions

The special capital region of Jakarta (DKI Jakarta) is the capital of Indonesia, with a total land area of 662.33 km^2 and has a total population of 10,562,088 as of 2020 (BPS-Statistics of DKI Jakarta Province, 2021). This region has province-level status and is divided into five administrative municipalities: Central Jakarta, North Jakarta, East Jakarta, South Jakarta, West Jakarta, and one administrative regency of Thousand Islands. Jakarta and its vicinities comprise a greater metropolitan area called Jabodetabek. This region consists of DKI Jakarta, Bekasi City, Bekasi Regency, Depok City, Bogor City, Bogor Regency, South Tangerang City, Tangerang City, and Tangerang Regency. Figure 2 gives an overview of the Jakarta Metropolitan Area (Jabodetabek). This metropolitan area covers 6,401 km^2 with a total population of 30,345,739 (Statistics Indonesia, 2021).

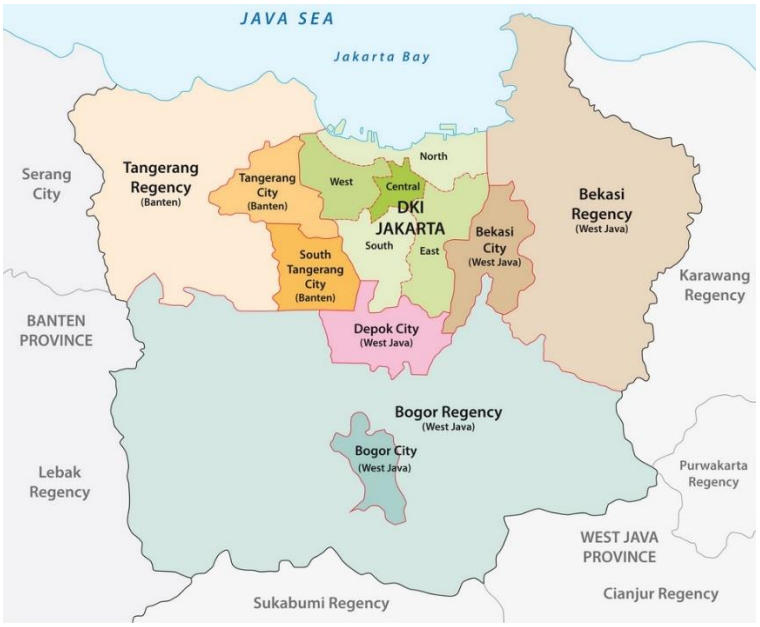


Figure 2. Map of Jakarta Metropolitan Area (Jabodetabek)

Source: http://vectorstock.com/

11.1% of the population in Jabodatebek are commuters, and Jakarta attracts 1,255,771 people from its vicinities on a daily basis, where 80.5% of them are workers (Statistics Indonesia, 2021). 79% of these commuters travel less than 30 km from home to their main destination, and 77.4% spend 30 to 90 minutes to arrive. The majority of these commuters (72%) are using a private vehicle to commute, and 55% spend at least Rp750,000.00/month (about USD52/ month) (15% of minimum wage of Jakarta) on commuter cost.

A reliable figure of how many houses have been produced in the Jakarta Metropolitan Area is unavailable. As an indication, the Ministry of Public Works and Housing made an assumption

in 2015 to handle this issue. The estimation is calculated using total population data, the estimated number of households in each family, and the assumption of homeownership percentage in each province (Ministry of Public Works, 2015). Using the same approach, it was estimated that the total stock of housing in the Jakarta Metropolitan Area was 5,478,483 units in 2015. If the rest of the households are also assumed to become homeowners, the total houses demanded in this region was 2,302,476 units, and the demand in Jakarta alone was estimated at 1,276,424 units. However, this assumption is very rough because the estimated number of households in each family was assumed to be the same for each province (3.9 persons) and the demand estimation assumed that all households should become a homeowner. In the same year, the provincial government of Jakarta published a Housing and Settlement Area Development Plan and stated Jakarta's population demanded 302,319 housing units in 2015. This number was different from the Ministry of Public Works' estimation, and no further explanation was revealed on how this number was estimated. However, the number is predicted to increase each year since the annual population growth rate is estimated to be 0.92 (BPS-Statistics of DKI Jakarta Province, 2021).

Government and developers (state-owned and private) supply this housing demand by developing apartment blocks in Jakarta and surrounding cities and landed homes in its vicinity. However, no reliable figure of housing supply in this region is available as well. As of 2020, the government has built 183 apartment blocks in Jakarta and contributed 28,766 units to the total stock (BPS-Statistics of DKI Jakarta Province, 2021). There is no further information in which period this total accumulation of stock started to count since some of the apartment blocks listed were built in 1995. The developers contributed 215,291 units to the total stock as of 2020 in Jakarta (Colliers, 2021). In the Jakarta Metropolitan Area (Jabodetabek), the developers also supply landed residential to accommodate the housing demand. These developments spread in the surrounding regions outside Jakarta and have contributed to 394,410 units of housing stock in Jabodetabek as of 2020 (Cushman & Wakefield, 2021). These reports did not give any information on which period of this total accumulation of stock started to count. These reports also did not provide any information about self-builders. Therefore, the size of the volume which is produced by self-builders is unknown.

3.2 Methodology

Numerous disciplines have discussed the topic of housing preferences, and many methods and approaches have emerged (Timmermans et al., 1994; Jansen et al., 2011). In this thesis, conjoint analysis is used to analyze housing preferences. This method is helpful in examining the residential characteristics, and tradeoffs that individuals make (Jansen et al., 2011). In addition, this method is also ideal to evaluate individuals' real preferences (van Ham, 2012a).

Jansen et al. (2011) explain in more detail the characteristics of the conjoint method from three dimensions. The first dimension is the origin of the data, the conjoint method is a stated preference. In the housing preference study, there are two types of data origin: revealed and stated preference. Revealed preference collects data based on the actual housing choice in real markets (van Ham, 2012b; Zinas and Jusan, 2012). Therefore, revealed preference often does not provide an insight into individuals' real choices because most people (have to) decide their house based on limited housing options in the real market and other constraints. In contrast, stated preference collects data based on people's reactions to hypothetical houses or intended housing choices from survey questions (Timmermans et al., 1994; Jansen et al., 2011). This approach is adequate to examine individuals' implicit residential preferences (Vasanen, 2012; Kamyar, 2019). Therefore, the conjoint method is suitable in this study to examine individuals' real preferences based on these arguments.

The second dimension refers to the freedom of attribute choice. The attribute choice in the conjoint method is restricted. This method provides a list of preselected attributes to choose from by the respondents. The negative side of this approach is that the respondents have no possibility to add additional attributes that are not included in this preselection. However, having freedom of attribute choice is considered costly and time-consuming because data collection requires face-to-face or telephone interviews (Jansen et al., 2011). Thus, the conjoint method is the best solution when there are constraints in time and finance. The third dimension refers to the measurement method in the housing preference studies. There are two types of measurement methods: compositional and decompositional methods. The compositional approach is asking respondents to evaluate the level of single housing attributes separately (Molin et al., 1996). For example, the respondents are asked to score the housing price attributes without knowing the other specific characteristics that this house offers in terms of size, location, dwelling type, etc. Therefore, this method is not able to examine the tradeoff between housing attributes. In contrast, a decompositional method evaluates alternatives and elaborates these into separate attribute levels (Jansen et al., 2011). Thus, this method is able to analyze the tradeoff between different housing attributes. To estimate the contributions of the attributes and attribute levels, statistical methods such as OLS and logistic regression analysis can be used for decomposing the overall preference measurement (Coolen and Jansen, 2012). Summarizing: the measurement method of conjoint analysis is decompositional and suitable for this study to examine the housing attributes tradeoffs that individuals make.

3.3 Conjoint Analysis

The objective of the conjoint method is to examine individuals' preferences for any type of object (Hair et al., 2010). In a housing preference study, housing profiles are described by combinations of attributes and attribute levels that are assumed to influence residential

preference (Timmermans et al., 1994; Jansen et al., 2011). Attributes are the characteristics of a house, such as dwelling type, size, location, etc. Each of these attributes is valued into different levels, for example, dwelling type is valued into two levels: landed house and apartment. These housing profiles are presented to the respondents and requested to evaluate each housing profile. The responses contain part-worth utility of each attribute level that contributes to the overall utility (holistic value) of housing alternatives. In this case, the overall utility is the dependent variable that is explained by the part-worth utility of each attribute level as the independent variable. The utility function of conjoint analysis can be expressed as follows:

$$U_{ij} = V_{ij} + \varepsilon_{ij} = \sum_{k=1}^{k} \beta_k X_{ijk} + \varepsilon_{ij} \quad (1)$$

Where,
U_{ij} = the overall utility of individual *j* to alternative *i*;
V_{ij} = the structural component of utility *i* for individual *j*;
ε_{ij} = an error component or part of utility that is not determined by the model
β_k = the utility constant for attribute level *k*
X_{ijk} = the value of attribute *k* describing alternative *i* for individual *j*
$\beta_k X_{ijk}$ = marginal utility contribution to the overall utility

In conjoint analysis, the respondents can evaluate the housing profiles in three different ways: ranking task, rating task, and choice task (Timmermans et al., 1994; Jansen et al., 2011). In a ranking task, the respondents are presented with all housing profiles and asked to rank them. In a rating approach, respondents are asked to give rating scores (for example, on a scale from 0 to 10) for each housing profile based on its degree of attractiveness. These evaluations can be analyzed further using ordinary least square regression analysis. In a choice task, the respondents are asked to choose between several housing profiles, and the multinomial logistic is the proper statistical analysis to conduct. Hair et al. (2010) explain that both ranking and rating approaches are more effective to be implemented if the number of attributes is less than ten attributes, while the choice approach is suggested to include not more than six attributes. The ranking task is not suitable for indirect evaluation because usually, the ranking procedure requires an interviewer and additional tools such as cards to compare each housing profile and rank them (Hair et al., 2010; Jansen et al., 2011). In addition, rating and choice tasks are easier to conduct. The evaluation of these approaches can be conducted by self-explanatory written questionnaires and distributed using postal surveys or the internet (Hair et al., 2010; Jansen et al., 2011). In addition, both of these approaches have the similar ability to predict holdout share well, and neither the rating-based nor choice-based approach predict better than others (Elrod et al., 1992; Moore, 2004). In this study, a rating-based approach is

preferred to measure individuals' evaluation of the housing profiles. Several authors, such as Timmermans et al. (1992) and Molin et al. (1997), used the same approach.

3.4 Constructing the conjoint experiment

The construction of a conjoint experiment requires some setup. This entails decision-making about selecting attributes, determining attributes level, and constructing the experimental design (Hair et al., 2010; Jansen et al., 2011). Each of these steps is discussed as follows:

Selection of attributes

The first step is the selection of attributes. It requires to include important housing characteristics that are assumed to influence individuals' housing preferences. These attributes can be obtained based on experience, literature research, or preliminary research (Jansen et al., 2011). In this study, the attributes are selected based on the literature study in the previous segment. There are many attributes in the previous study that influence housing preferences. However, to implement a rating-based conjoint effectively, the number of attributes is suggested not to be over ten attributes (Hair et al., 2010). Therefore, in this thesis, six attributes are selected.

According to the literature study, there are five common housing attributes that are significant in determining housing preferences: tenure option, housing cost, dwelling type, size, and location. In this study, all these housing attributes are considered. The location attribute, in particular, is represented by two attributes: distance to public transportation and distance to shops, since these attributes are mentioned several times in literature studies. Therefore, in total, six housing attributes are included: tenure option, housing cost, dwelling type, size, distance to public transportation, and distance to shops. The description of each attribute can be observed in Table 2.

Table 2. The selected attributes

Attributes	Descriptions
Tenure option	Preferred tenure option
Housing cost	Housing monthly cost in Indonesian Rupiah (Rp)
Dwelling type	Type of housing
Size	Total floor area in m^2
Distance to public transportation	Distance to the closest public transportation in km
Distance to shops	Distance to the closest shops in km

Determination of attributes level

Once the attributes have been selected, the second step is to determine the attributes level and its value. In this research, the tenure option is defined into two attribute levels: rent and ownership. Housing cost is represented by monthly cost with three attribute levels: < Rp2

million (about USD138), Rp2 million – Rp3 million (about USD138 – USD206), and > Rp3 million (about USD206). These attribute levels are based on the Indonesia Property Watch survey reported by Ramadhani (2018), which categorizes the monthly housing cost in Jakarta into these three categories. The dwelling type is defined into two attribute levels: landed house and apartment. These levels are based on the Decree of the Ministry of Public Works and Housing number 242/KPTS/M/2020, which categorizes housing types in Indonesia into landed houses and apartments. In Indonesia, the size of the house is commonly represented by floor area. According to RayWhite Indonesia (2021), the most common floor area is 21 m^2, 36 m^2, and 45 m^2. The 21 m^2 type is a studio-style house, typically consisting of one large room that serves as the combined bedroom, living, dining, and one bathroom. The 36 m^2 type typically has two bedrooms, one bathroom, and a combined living and dining room. The 45 m^2 type is basically similar to the 36 m^2 type with larger space. There is another type in between 21 m^2 and 36 m^2, which is 27 m^2. This type typically has one dedicated room for a bedroom, one bathroom, and a combined living and dining room. To make the size distinctive according to its typical number of bedrooms, the dwelling size is defined into three attribute levels: 21 m^2 (studio), 27 m^2 (one bedroom), and 36 m^2 (two bedrooms). The location characteristics in this study are represented by distance to public transportation and distance to shops. The distance is classified into three attribute levels in both attributes: < 1 km, 1 – 5 km, > 5 km. The determination of these distances is based on two justifications. First, the commuter train line, the main public transportation mode that services the metropolitan area, which has one line for each surrounding city (see Appendix A). Thus, the chance to have a house far from the commuter station is high. Second, the neighborhood of the surrounding station is very diverse in the metropolitan area. Some neighborhoods have been developed and served by shopping centers, supermarkets, mall, etc., while others are less developed. The people who live in less developed neighborhoods need to go more than five kilometers to the nearest city centers to find a shopping center or supermarket.

Table 3. The attribute levels

Attributes	Attribute levels
Tenure option	Rental houses Owner-occupied houses
Housing cost	< Rp2 million (about USD138) Rp2 million – Rp3 million (about USD138 – USD206) > Rp3 million (about USD206)
Dwelling type	Landed house Apartment
Size	21 m^2 (studio) 27 m^2 (1 bedroom) 36 m^2 (2 bedrooms)
Distance to public transportation	< 1 km

	1 – 5 km > 5 km
Distance to shops	< 1 km 1 – 5 km > 5 km

Given the approach (rating based), attributes, and levels selected, the conjoint model in this study is expressed as follow:

$$U_\gamma = \beta_0 + \sum_{h=1}^{h} \beta_{1i} X_{1i} + \sum_{h=1}^{h} \beta_{2j} X_{2j} + \sum_{h=1}^{h} \beta_{3k} X_{3k} + \sum_{h=1}^{h} \beta_{4l} X_{4l} + \sum_{h=1}^{h} \beta_{5m} X_{5m} + \sum_{h=1}^{h} \beta_{6n} X_{6n} + \varepsilon \quad (2)$$

Where,

U_γ = the overall utility of individual γ represented by the accumulation score of part-worth utility
β_0 = the constant coefficient
X_{1i} = the part-worth utility of tenure option *(1)* that associated with levels *i* (*i*=1,2)
β_{1i} = the coefficient of X_{1i}
X_{2j} = the part-worth utility of housing cost *(2)* that associated with levels *j* (*j*=1,2,3)
β_{2j} = the coefficient of X_{2j}
X_{3k} = the part-worth utility of dwelling type *(3)* that associated with levels *k* (*k*=1,2)
β_{3k} = the coefficient of X_{3k}
X_{4l} = the part-worth utility of dwelling size *(4)* that associated with levels *l* (*l*=1,2,3)
β_{4l} = the coefficient of X_{4l}
X_{5m} = the part-worth utility of distance to public transportation *(5)* that associated with levels *m* (*m*=1,2,3)
β_{5m} = the coefficient of X_{5m}
X_{6n} = the part-worth utility of distance to shops *(6)* that associated with levels *n* (*n*=1,2,3)
β_{6n} = the coefficient of X_{6n}
ε = error term

Hair et al. (2010) explain that the assumptions associated with model estimation are the least restrictive in conjoint analysis. Because of the model's generalized nature and structured experimental design, the majority of tests performed in other dependence methods are no longer necessary. Therefore, statistical tests such as normality, homoscedasticity, and independence are not necessary for conjoint analysis. Unlike regression, the additional effects in conjoint analysis (interaction or nonlinear terms) cannot be easily evaluated after the data are collected. The assumptions are emphasizing in the appropriateness of the model form and the representativity of the sample. Therefore, in conjoint analysis, the researcher must make a decision regarding model form and then design the research accordingly.

Constructing the experimental design

The third step is constructing the experimental design by combining attributes and attribute levels into housing profiles. There are three types of experimental designs to construct the

housing profile: full-factorial designs, fractional factorial designs, and compromise designs (Jansen et al., 2011). A full-factorial design involves all possible combinations of attributes and attribute levels. This approach is able to examine all interaction effects. However, this approach will generate too many housing profiles and make the experiment hard to handle. Applying full factorial design in this study with two two-level attributes and four three-level attributes will generate $2^2 * 3^4 = 324$ housing profile combinations. Therefore, this thesis applies a fractional-factorial design.

A fractional-factorial design is the most common approach to construct a set of profiles (Hair et al., 2010). The selection of housing profiles in a fractional-factorial design is usually an orthogonal selection of the full-factorial design (Jansen et al., 2011). This step is important to obtain unbiased estimates of the main effect. The attribute levels are combined to obtain an orthogonal correlation structure between the attributes (Molin et al., 1996). The orthogonal selection means the optimal design that the attributes are uncorrelated to all the profiles. As a result, this approach reduces the number of housing profiles, but at the same time, still represents the main effect of the entire full-factorial design. Rating-based experiments, having uncorrelated attributes, give benefit since the lowest number of observations may arrive at statistical significance for the estimated coefficients (Jansen et al., 2011).

The fractional-factorial design in this study is constructed by utilizing a software package of IBM SPSS statistics 27. The software generates sixteen combinations of housing profiles (see Table 4). This number is adequate for the minimum profile requirement, which is eleven when two two-level attributes and four three-level attributes are included (Hair et al., 2010). These sixteen housing profiles are presented to the respondents and requested to evaluate each housing profile on a rating-based basis. The scale is between 0 to 10, where scale 0 if the housing profile is extremely unattractive to 10 if the housing profile is extremely attractive. The housing profiles in the questionnaire are presented in Appendix B.

Table 4. Hypothetical housing profiles

Profile	Tenure option	Housing cost	Dwelling type	Size	Distance to public transport	Distance to shops
1	Rental house	Rp 2 million - Rp 3 million	Landed house	36 m2	< 1 km	< 1 km
2	Rental house	< Rp 2 million	Landed house	27 m2	> 5 km	> 5 km
3	Rental house	< Rp 2 million	Apartment	27 m2	1 – 5 km	< 1 km
4	Rental house	< Rp 2 million	Apartment	21 m2	< 1 km	1 – 5 km
5	Owner-occupied house	Rp 2 million - Rp 3 million	Apartment	21 m2	1 – 5 km	> 5 km
6	Owner-occupied house	< Rp 2 million	Landed house	36 m2	1 – 5 km	< 1 km

7	Owner-occupied house	> Rp 3 million	Apartment	27 m2	< 1 km	< 1 km
8	Owner-occupied house	Rp 2 million - Rp 3 million	Landed house	27 m2	< 1 km	1 – 5 km
9	Rental house	> Rp 3 million	Landed house	21 m2	1 – 5 km	1 – 5 km
10	Rental house	> Rp 3 million	Apartment	36 m2	< 1 km	> 5 km
11	Owner-occupied house	< Rp 2 million	Landed house	21 m2	< 1 km	> 5 km
12	Owner-occupied house	< Rp 2 million	Apartment	21 m2	< 1 km	< 1 km
13	Owner-occupied house	> Rp 3 million	Landed house	21 m2	> 5 km	< 1 km
14	Rental house	Rp 2 million - Rp 3 million	Apartment	21 m2	> 5 km	< 1 km
15	Owner-occupied house	< Rp 2 million	Apartment	36 m2	> 5 km	1 – 5 km
16	Rental house	< Rp 2 million	Landed house	21 m2	< 1 km	< 1 km

Examining the heterogeneity of the conjoint result

Housing preference may differ depending on several factors such as people's resources, restrictions, opportunities, and constraints. Thus, examining the heterogeneity of the conjoint result may give a better understanding of the workers' preferences. In this study, segment-based models and cluster analysis are implemented to analyze this issue further. For the segment-based model, the conjoint analysis will be carried out separately based on income groups. A respondent with a maximum income of Rp5 million/ month (about USD344/ month) is considered low income, and a respondent with a range of more than Rp5 million/ month until Rp8 million/ month (about USD550/ month) is considered as middle income. To observe the sensitivity of the results, what-if analysis is conducted using choice simulators. This method aims to simulate scenarios and estimate how the respondents would react to each scenario based on the estimated part-worths of each respondent (Hair et al., 2010). In this case, the maximum utility (first choice) model is used in the choice simulators. This approach assumes the respondent selects the profile with the highest predicted utility score (Hair et al., 2010).

Cluster analysis will also be implemented to analyze the heterogeneity of the preferences further. Cluster analysis has been applied in previous studies to examine the heterogeneity of the conjoint result and determine customer segmentation (Hair et al., 2010, Jansen et al., 2011; Popovic et al., 2016; Vukic et al., 2015; Mankila, 2004). Cluster analysis assesses the variance of the part-worth value to examine different preference classes. However, one of the limitations or criticisms towards this analysis is that cluster analysis has no statistical foundation to interpret results from a sample to the entire population (Hair et al., 2010). Thus, a strong conceptual basis is required to support the application of this analysis (Hair et al., 2010). In this

case, the conceptual basis to apply this analysis has been discussed in the previous chapter. The housing preference may be differed according to individual's life-course career, family career, resources, constraints, etc. not only based on income. Therefore, derived from this conceptual basis, applying cluster analysis is suitable to examine further the housing preference of workers in Jakarta not only based on the income category but also from the other socio-demographic factors. In this study, K-means cluster procedure in IBM SPSS statistics 27 is used to examine different clusters of housing characteristics according to the part-worth (attribute) value and investigates the other socio-demographic factors that may influence the different preferences of each housing characteristics[2]. The results may give better insight for developers to decide which housing attributes should be emphasized for different types of workers.

3.5 Survey Procedure

After constructing the conjoint experiment, a standardized digital questionnaire is created in Bahasa Indonesia since the target group comprises workers in Jakarta via a web-based survey creator, Qualtrics. The English version is also provided and can be observed in Appendix B. The online survey link that contains the digital questionnaire will be distributed to several workers' WhatsApp groups in Jakarta, a common platform to share information among workers. Hair et al. (2010) explain that a minimum of 50 respondents can provide a glimpse into the preferences of respondents, and a sample size of 200 being found to provide an acceptable margin error. Therefore, a minimum of 150-200 respondents is targeted to participate in this survey. This method has been applied in previous conjoint studies—Vukic et al. (2015) study generation Y's preference for traveling. The data collection was also conducted via a web-based questionnaire and using social media (Facebook and Twitter) and electronic mail to distribute the digital questionnaire. In total, 508 completed and valid questionnaires were collected (97.1% success rate). Sulistyawati et al. (2020) analyzed consumer preference for fried mango and used an online survey to collect data. The online survey was distributed among the targeted respondents (university students and employees) who live in the Netherlands, China, and Indonesia via emails, social media (Facebook), and personal message applications (WhatsApp and Line). A total of 638 respondents participated, of which 483 gave a valid answer (75.7% success rate). Some advantages of data collection using an online survey are: 1) the collected data are simple to export into SPSS or Excel format, and 2) a large number of people can participate in the survey simultaneously (Vukic et al., 2015).

[2] Silhouette metric, an analysis to evaluate the optimal number of clusters derived from K-means (Lensen et al., 2017), is not the focus of discussion in this study. The discussion of cluster analysis in this study is focussed to investigate the heterogeneity of housing preferences among workers in Jakarta not only by income category but also from the other socio-demographic factors.

Since this survey has a specific target group of workers, the sampling method is purposive sampling. Purposive sampling is a non-probability sampling method and has some advantages, such as being easier to obtain and less expensive (Bellhouse, 2007). However, this approach may lead to bias in subject selection if the requirement is too subjective to the researcher's judgment. To overcome this potential problem, specific requirements are subjected to the sample selection. In this study, the specific requirements of the target group of workers are: 1) working in Jakarta, 2) does not own a house, and 3) has a maximum salary of Rp8 million/ month (about USD550/ month). Therefore, based on these requirements, the respondent in this study consists of starters or renters who are currently working in Jakarta and living in Jabodetabek and looking for a different type of house.

The survey is divided into three sections. The first section is a preliminary question to filter the sample according to the specific requirements. If one of the requirements is not fulfilled by the respondent, the survey will automatically end. The second section contains some questions about the socio-demographic condition of the respondent. The third part is the rating-based conjoint experiment. Some housing profiles, which are not fully hypothetical, are provided with an existing example to give a better understanding in evaluating the housing profile. Four out of sixteen housing profiles are not provided with an existing example. The survey questionnaire can be found in appendix B.

Since this survey contains sensitive data of the respondents, several ethical issues are considered to prevent the respondents from being harmed. To overcome this potential issue, the front page of the questionnaire states explicitly that all given answers are handled confidentially and only used for scientific purposes. In addition, to avoid any flaw of the survey or confusion of the questions, this survey underwent a pre-test among several workers in Jakarta. Any constructive feedback has been considered, followed by reformulation of the survey.

3.6 The final stage of operationalization

The online survey link that contains the digital questionnaire was initially sent to sixteen WhatsApp groups that the author has in his contact list. The author also asked 54 colleagues with different backgrounds to share the survey link to their WhatsApp groups. These colleagues are colleagues from work (co-workers in head office and branch offices in Jakarta, team mates, ex interns, and suppliers), Author’s friends, and family members who work in Jakarta. After four days of the initial distribution, the survey link was re-announced again in the groups as a reminder to complete or to participate in the survey. After eight days of the initial distribution, the survey was ended since no more new respondents participated.

In total, 748 respondents participated in this survey. Eleven respondents decided not to continue the survey. 457 respondents did not meet three specific requirements of the respondent criteria in this study. 78 respondents did not complete the survey. Two respondents completed the survey but gave a monotonous/identical rating. Those respondents were removed, and in total, 200 observations are included in this study.

3.7 Descriptive analysis

The survey contains socio-demographic questions to determine the characteristics of the respondents. The data are analyzed by using a software package of StataSE 16. The log file of dataset arrangement and descriptive statistics of these data can be observed in Appendix C. The results are explained in this section.

This study has an intentionally selective sample; therefore, this is not a representative sample of all workers. In this case, the respondents are starters or renters who are currently working in Jakarta, living in Jabodetabek, and looking for a different type of house. Thus, the sample is relevant to this study. The majority of these respondents are single households, 65%, with an average age of 27.5 years. Most of them (60%) are permanent contracts, while the rest (40%) are freelance and temporary contracts. The majority of the respondents, 73%, are classified as middle-income workers with a net salary range from more than Rp 5 million to Rp 8 million per month (about USD344 – USD550 per month), and 27% are low-income workers with a net salary lower than Rp 5 million per month (about USD344). Most of the respondents have 2-5 years of working experience, and most of them use private vehicles to their offices. The most common private vehicle in Jakarta is the motorcycle because the cost is lower and more flexible compared to using public transportation. However, it is more exhausting due to traffic jams and less comfortable.

Table 5. Descriptive statistics

		Descriptive
Age (in years)	Mean	27.5
	SD	4.6
	Min	20
	Max	53
Gender	Male	47%
	Female	53%
Marriage status and household state	Single	65%
	Married, without child	13%
	Married, with child(ren)	20%
	Others	2%
Type of occupation	Flex (freelance)	7%
	Temporary contract	33%
	Permanent contract	60%
Net salary per month	≤ Rp 5 million	27%

	> Rp 5 million to Rp 8 million	73%
Length of work	< 2 years	33%
	2 – 5 years	45%
	> 5 years	22%
Number of income earners in the household	Single	71%
	Dual	29%
Transportation mode to workplace	Private vehicle	52%
	Public transportation	28%
	Mix private and public transportation	20%

Note: N = 200

Table 6 summarizes the total score of sixteen housing profiles. With 200 respondents, each profile can get a maximum rating score of 2000. The most popular housing profiles are profile number 6 with an overall rating of 1498/2000, followed by profile number 12 and 8 with an overall rating of 1123/2000 and 1075/2000, respectively. Housing profile number 6 has no existing example in the Jakarta Metropolitan Area (hypothetical). This profile is a landed and an owner-occupied house with big size (36 m^2), affordable (< Rp 2 million), close to shopping centers (< 1 km), and near public transportation (within 1-5 km). While profile numbers 12 and 8 are not purely hypothetical. Both of them are owner-occupied houses, close to public transportation (< 1 km), and have an affordable price (< Rp 2 million or Rp 2 million - Rp 3 million).

The least popular housing profiles are profile number 2 with an overall rating of 577/2000, followed by profile number 14 with an overall rating of 686/2000, and profile number 10 with an overall rating of 773/2000. Housing profile number 10 has no existing example in the Jakarta Metropolitan Area (hypothetical), while the others are not purely hypothetical. All these three profiles are rental houses, that are far from both shops and public transportation, either affordable or expensive.

Table 6. Housing profiles' overall rating

Profile	Housing attributes	Levels	Overall Rating	Rank
1	Tenure option	Rental house	936	10
	Housing cost	Rp 2 million - Rp 3 million		
	Dwelling type	Landed house		
	Size	36 m2		
	Distance to public transport	< 1 km		
	Distance to shops	< 1 km		
2	Tenure option	Rental house	577	16
	Housing cost	< Rp 2 million		
	Dwelling type	Landed house		
	Size	27 m2		
	Distance to public transport	> 5 km		
	Distance to shops	> 5 km		

3	Tenure option	Rental house	991	8
	Housing cost	< Rp 2 million		
	Dwelling type	Apartment		
	Size	27 m2		
	Distance to public transport	1 – 5 km		
	Distance to shops	< 1 km		
4	Tenure option	Rental house	938	9
	Housing cost	< Rp 2 million		
	Dwelling type	Apartment		
	Size	21 m2		
	Distance to public transport	< 1 km		
	Distance to shops	1 – 5 km		
5	Tenure option	Owner-occupied house	996	7
	Housing cost	Rp 2 million - Rp 3 million		
	Dwelling type	Apartment		
	Size	21 m2		
	Distance to public transport	1 – 5 km		
	Distance to shops	> 5 km		
6	Tenure option	Owner-occupied house	1498	1
	Housing cost	< Rp 2 million		
	Dwelling type	Landed house		
	Size	36 m2		
	Distance to public transport	1 – 5 km		
	Distance to shops	< 1 km		
7	Tenure option	Owner-occupied house	1009	5
	Housing cost	> Rp 3 million		
	Dwelling type	Apartment		
	Size	27 m2		
	Distance to public transport	< 1 km		
	Distance to shops	< 1 km		
8	Tenure option	Owner-occupied house	1075	3
	Housing cost	Rp 2 million - Rp 3 million		
	Dwelling type	Landed house		
	Size	27 m2		
	Distance to public transport	< 1 km		
	Distance to shops	1 – 5 km		
9	Tenure option	Rental house	794	13
	Housing cost	> Rp 3 million		
	Dwelling type	Landed house		
	Size	21 m2		
	Distance to public transport	1 – 5 km		
	Distance to shops	1 – 5 km		
10	Tenure option	Rental house	773	14
	Housing cost	> Rp 3 million		
	Dwelling type	Apartment		
	Size	36 m2		
	Distance to public transport	< 1 km		
	Distance to shops	> 5 km		
11	Tenure option	Owner-occupied house	999	6
	Housing cost	< Rp 2 million		
	Dwelling type	Landed house		
	Size	21 m2		
	Distance to public transport	< 1 km		
	Distance to shops	> 5 km		

12	Tenure option	Owner-occupied house	1123	2
	Housing cost	< Rp 2 million		
	Dwelling type	Apartment		
	Size	21 m2		
	Distance to public transport	< 1 km		
	Distance to shops	< 1 km		
13	Tenure option	Owner-occupied house	837	12
	Housing cost	> Rp 3 million		
	Dwelling type	Landed house		
	Size	21 m2		
	Distance to public transport	> 5 km		
	Distance to shops	< 1 km		
14	Tenure option	Rental house	686	15
	Housing cost	Rp 2 million - Rp 3 million		
	Dwelling type	Apartment		
	Size	21 m2		
	Distance to public transport	> 5 km		
	Distance to shops	< 1 km		
15	Tenure option	Owner-occupied house	1072	4
	Housing cost	< Rp 2 million		
	Dwelling type	Apartment		
	Size	36 m2		
	Distance to public transport	> 5 km		
	Distance to shops	1 – 5 km		
16	Tenure option	Rental house	894	11
	Housing cost	< Rp 2 million		
	Dwelling type	Landed house		
	Size	21 m2		
	Distance to public transport	< 1 km		
	Distance to shops	< 1 km		

Note: N = 200

4. RESULTS

4.1 Rating-based conjoint analysis

The data of rating-based conjoint is analyzed using a software package of IBM SPSS statistics 27. Using this software, the relative contribution of each attribute level was estimated by applying ordinary least square regression analysis. The syntax code can be found in Appendix D.

The results show that the mean Pearson product-moment correlation between the respondent's observed and estimated preferences scores is 0.985 at a significance level of 0.01, indicating a good predictive ability of the model. Table 7 summarizes the part-worth utilities for the attribute levels, the estimated standard error, t-value, and relative importance value. The results show that the dwelling type attribute is not significant in the utility estimation, while the others are found to be significant. This result presumably is caused by the fact that the culture of apartment living has been commonly accepted by the respondents. Therefore, they do not have any problem whether to live in an apartment or landed house, as long as the other attributes such as the tenure option, housing cost, dwelling size, distance to public transportation, and shops fulfill their needs.

A positive and higher utility estimation implies a greater preference for a specific attribute level, while a lower negative utility implies an aversion toward the specific attribute level. The results suggest that an owner-occupied house is more preferred than a rental house in terms of tenure option. In respect of dwelling type, a landed house is more preferred than an apartment. The housing preferences utility increases with decreasing housing cost, increasing size, and decreasing distance to shops. In addition, the distance to public transportation has a different pattern, the most preferred distance is 1 – 5 km, while being closer (< 1 km) to public transportation is the second preferred. Having an owner-occupied house and the distance to public transportation of 1 – 5 km are the most preferred levels with 0.631 and 0.630 utility points, respectively. In addition, the distance to public transportation of > 5 km is the most aversion attribute level with -0.754 utility points, followed by having a rental house with -0.631 utility points.

Table 7. Rating-based conjoint result

Attribute	Level	Part-worth utilities	Standard Error	t-value	Average importance value[a]
Tenure option	Rental houses	-0.631	0.078	-8.090	16.55%
	Owner-occupied houses	0.631	0.078	8.090	

Housing cost	< Rp2 million	0.411	0.104	3.952	18.39%
	Rp2 million – Rp3 million	-0.030	0.122	-0.246	
	> Rp3 million	-0.380	0.122	-3.115	
Dwelling type	Landed house	0.007	0.078	0.090	9.81%
	Apartment	-0.007	0.078	-0.090	
Size	21 m^2	-0.277	0.104	-2.663	18.25%
	27 m^2	-0.254	0.122	-2.082	
	36 m^2	0.53	0.122	4.344	
Distance to public transportation	< 1 km	0.123	0.104	1.183	20.91%
	1 – 5 km	0.630	0.122	5.164	
	> 5 km	-0.754	0.122	-6.180	
Distance to shops	< 1 km	0.312	0.104	3.000	16.09%
	1 – 5 km	0.177	0.122	1.451	
	> 5 km	-0.490	0.122	-4.016	
Constant		4.607	0.094	49.011	

Note: the mean Pearson product-moment correlation = 0.985 at a significance level of 0.01[3].

[a] The importance values are estimated on each individual by taking the part-worth utility range separately and dividing by the sum of all the part-worth utilities range. The average importance values are estimated by averaging the importance values of each part-worth over all the individuals.

The average importance value of each attribute could give tradeoff information. It is estimated that the most important attribute is the distance to public transportation followed by housing cost. Dwelling size, tenure option, distance to shops, and dwelling type are followed afterwards, where dwelling type is the least important. These results imply that when all these attributes are evaluated at once, the workers consider distance to public transportation and housing cost the most and compensate (tradeoff) with the other attributes. These results are consistent with the a priori hypothesis 1 and aligned with previous studies.

4.2 The heterogeneity of the conjoint result

The heterogeneity test of the conjoint result may give a better understanding of the workers' preferences. In this study, the heterogeneity is examined based on the segment-based models and cluster analysis.

Segment-based models

Table 8 summarizes the socio-demographic condition between low-income and middle-income workers. The majority of the respondents in both income levels are single households with an average age of 27 years old. The most significant differences examined from these two income

[3] The conjoint analysis in IBM SPSS statistics only reports two statistics: Pearson's *R* and Kendall's tau, which measure the correlation between the observed and estimated preferences. Residual sum of squares, R-squared, and F statistics of the model are not reported by the program. Journals that specifically using rating-based conjoint analysis in housing preference studies such as Molin et al. (1997) and Timmermans et al. (1992) and in general economic and social studies such as Mankila (2004), Vukic et al. (2015), and Popovic et al. (2016) do not report the R-squared and F statistics of the model as well.

groups are the type of occupation, length of work, and transportation mode to work among the income levels. The majority of low-income workers (71%) have a temporary contract or freelance status, and in terms of length of work, most of them just entered the job market with experience less than two years (61%). In contrast, the majority of middle-income workers have a permanent contract (70%) with experience of more than two years (78%). One of the interesting parts of these results is the selection of transportation mode to the workplace by the workers. Low-income workers tend to use a private vehicle (61%) such as a motorcycle to their workplace because the cost is lower but more exhausting and less comfortable. In contrast, most middle-income (51%) choose to use public transportation or a mix of private and public transportation.

Table 8. Socio-demographic of low- and middle-income workers

		All	Low income	Middle income
Age (in years)	Mean	27.5	26.3	27.7
	SD	4.6	6.3	4.2
	Min	20	20	20
	Max	53	53	46
Gender	Male	47%	43%	49%
	Female	53%	57%	51%
Marriage status and household state	Single	65%	76%	62%
	Married, without child	13%	9%	15%
	Married, with child(ren)	20%	13%	22%
	Others	2%	2%	1%
Type of occupation	Flex (freelance)	7%	17%	4%
	Temporary contract	33%	54%	26%
	Permanent contract	60%	29%	70%
Net salary per month	≤ Rp 5 million	27%	100%	0%
	> Rp 5 million to Rp 8 million	73%	0%	100%
Length of work	< 2 years	33%	61%	22%
	2 – 5 years	45%	28%	51%
	> 5 years	22%	11%	27%
Number of income earners in the household	Single	71%	80%	68%
	Dual	29%	20%	32%
Transportation mode to workplace	Private vehicle	52%	61%	49%
	Public transportation	28%	32%	26%
	Mix private and public transportation	20%	7%	25%

Note: N low-income = 54 and middle-income = 146.

Table 9 summarizes the part-worth utilities for the attribute levels, the estimated standard error, and the t-value based on two segments: low and medium income. The results show that the most preferred levels of low-income workers are the distance to public transportation of 1 – 5

km and having an owner-occupied house with 0.625 and 0.484 utility points, respectively. In addition, the most aversion attribute levels are the distance to public transportation of > 5 km and having a rental house with -0.606 and -0.484 utility points, respectively. These results are not consistent with the a priori hypothesis, where it is hypothesized that low-income workers would prefer rental houses (-0.484 utility points) with smaller floor areas (-0.170 utility points). These results are expected due to the approach of this study, which is a stated preference, which focuses on the original or real preferences based on hypothetical houses. The low-income workers will maximize their utility as long as the hypothetical house options are provided in the profiles.

The greatest preference for medium-income workers is having an owner-occupied house with 0.686 utility points, followed by the distance to public transportation of 1 – 5 km with 0.632 utility points and dwelling size with 0.598 utility points. The most disliked attribute levels for medium-income are the distance to public transportation of > 5 km with -0.808 utility points and having a rental house with -0.686 utility points. In terms of dwelling types, low-income workers prefer to live in an apartment while medium-income workers prefer to live in landed houses. These results are consistent with the a priori hypothesis, where it is hypothesized that medium-income workers would prefer an owner-occupied house (0.686 utility points) with larger floor areas (0.598 utility points).

Table 9. Segmented rating-based conjoint result

		Low Income			Medium Income		
Attribute	Level	Utility	SE	t-value	Utility	SE	t-value
Tenure option	Rental houses	-0.484	0.071	-6.82	-0.686	0.087	-7.89
	Owner-occupied houses	0.484	0.071	6.82	0.686	0.087	7.89
Housing cost	< Rp2 million	0.410	0.095	4.32	0.411	0.117	3.51
	Rp2 million – Rp3 million	-0.124	0.111	-1.12	0.004	0.137	0.03
	> Rp3 million	-0.286	0.111	-2.58	-0.415	0.137	-3.03
Dwelling type	Landed house	-0.06	0.071	-0.85	0.032	0.087	0.37
	Apartment	0.06	0.071	0.85	-0.032	0.087	-0.37
Size	21 m^2	-0.170	0.095	-1.79	-0.316	0.117	-2.70
	27 m^2	-0.177	0.111	-1.59	-0.282	0.137	-2.06
	36 m^2	0.346	0.111	3.12	0.598	0.137	4.36
Distance to public transportation	< 1 km	-0.019	0.095	-0.20	0.176	0.117	1.50
	1 – 5 km	0.625	0.111	5.63	0.632	0.137	4.61
	> 5 km	-0.606	0.111	-5.46	-0.808	0.137	-5.90
	< 1 km	0.256	0.095	2.69	0.333	0.117	2.85

Distance to shops	1 – 5 km	0.194	0.111	1.75	0.172	0.137	1.26
	> 5 km	-0.450	0.111	-4.05	-0.505	0.137	-3.69
Constant		4.871	0.086	56.64	4.509	0.105	42.94

Note: N low-income model = 54 and middle-income model = 146. The mean Pearson product-moment correlation for low-income model = 0.981 at a significance level of 0.01 and for middle-income model = 0.984 at a significance level of 0.01.

Figure 4 shows the relative importance of attributes between low-income workers and medium-income workers. For low-income workers, it is estimated that the most important attribute is the distance to public transportation (20.42%), followed by housing cost (20.11%). Dwelling size (18.56%), distance to shops (15.33%), tenure option (15.09%), and dwelling type (10.49%) follow afterwards. In addition, the most important attributes for medium-income workers are distance to public transportation (21.1%) and dwelling size (18.14%). Housing cost (17.76%), tenure option (17.09%), distance to shops (16.37%), and dwelling type (9.56%) follow afterwards. These results indicate that there are different preferences among the workers.

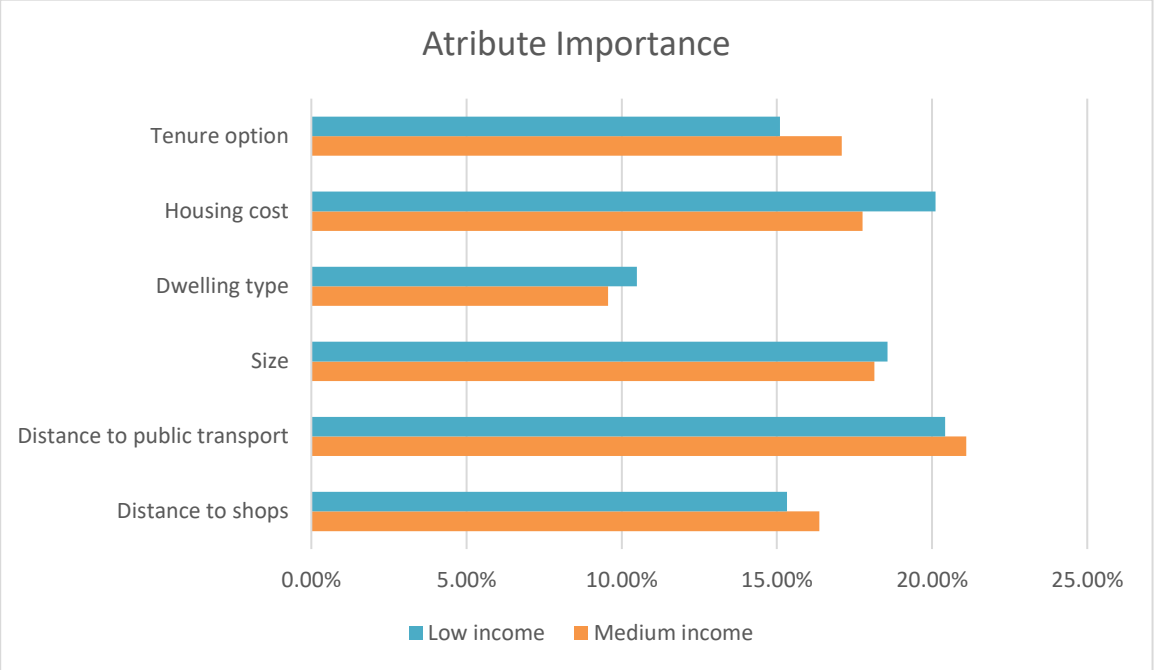


Figure 4. The attribute importance

To observe the sensitivity of these results, what-if analysis of choice simulators is conducted using the maximum utility (first choice) model. Housing profiles and their share of preferences calculated using the maximum utility (first choice) model are shown in Table 10. Two scenarios with two different housing profiles are observed. Scenario 1 emphasizes the distance to public transport and housing cost to represent the attribute importance of low-income workers, and scenario two emphasizes the distance to public transport and dwelling size to represent the attribute importance of middle-income workers. In scenario 1, only 84.67% of middle-income

workers choose housing profile 1. In contrast, 91.89% of these workers choose housing profile 1 in scenario 2. These results confirm the segment-based models that show the attribute importance of middle-income workers are distance to public transport and dwelling size.

In scenario 1, 80.36% of low-income workers choose housing profile 1 compared to profile 2, which has higher costs and is far from public transportation (the other attributes remain the same). These results confirm the previous segment-based models that show the attribute importance of middle-income workers are distance to public transport and housing cost. However, the percentage of low-income workers who choose housing profile 1 in scenario 2 that emphasizes distance to public transport and dwelling size is slightly higher than housing profile 1 in scenario 1. Several reasons may cause these results: 1) dwelling size is also the third important attribute for low-income workers, and 2) the sample size of low-income workers (54 respondents) is lower compared to middle-income workers (146 respondents); therefore, the middle-income model may have better prediction compared to the low-income model. More details of the result on each respondent can be observed in Appendix E.

Table 10. What-if analysis

Housing profiles	Characteristics	Low-income	Middle-income
		Maximum utility model (%)	Maximum utility model (%)
Scenario 1			
1	Tenure option: rental house Housing cost: < Rp 2 million/ month Dwelling type: landed house Size: 21 m2 Distance to public transportation: 1-5 km Distance to shops: > 5 km	80.36%	84.67%
2	Tenure option: rental house Housing cost: > Rp 3 million/ month Dwelling type: landed house Size: 21 m2 Distance to public transportation: > 5 km Distance to shops: > 5 km	19.64%	15.33%
Scenario 2			
1	Tenure option: rental house Housing cost: > Rp 3 million/ month Dwelling type: apartment Size: 36 m2 Distance to public transportation: 1-5 km Distance to shops: > 5 km	82.14%	91.89%
2	Tenure option: rental house Housing cost: > Rp 3 million/ month Dwelling type: apartment Size: 21 m2 Distance to public transportation: > 5 km Distance to shops: > 5 km	17.86%	8.11%

Cluster analysis

K-means cluster in IBM SPSS statistics 27 is used to investigate the heterogeneity of the preferences further. This analysis clusters bundles of housing characteristics based on the part-worth (attribute) value and investigates the other factors that may influence the different preferences of each housing characteristics. The analysis revealed that four clusters are significant in representing the housing characteristics. The importance values of attributes for each cluster are summarized in Figure 5, and the ANOVA table can be seen in Appendix E.

The first cluster includes small group of respondents, only eleven out of two hundred respondents (5.5% of the total sample). This cluster's most important attribute is the tenure option (38.14%), dwelling type (20.74%), and distance to shops (13.71%). The least important for them are dwelling size (7.99%), housing cost (9.03%), and distance to public transportation (10.39%). The most significant type of respondents in this cluster are workers who use a private vehicle to their workplace (72.73%). Previously, the results show that distance to public transportation is the most important attribute. However, since most workers in this cluster are using private vehicles to their workplace, distance to public transportation becomes one of the least preferred attributes.

The second cluster includes 40 respondents (20% of the total sample). The preferable attribute for this cluster is the tenure option (32.76%) and distance to public transportation (16.91%), and the aversion attribute is the dwelling type (5.63%). The most significant respondents in this cluster are workers with medium income salaries (80%) and single households (65%). Being single and having a medium-income salary might contribute to their preference, which does not matter if they should live in an apartment or landed house as long as it is an owner-occupied house.

The third cluster are the largest group and includes 97 respondents (48.5% of the total sample). The most important attribute for this cluster is the distance to public transportation (28.1%), housing cost (21.12%), and distance to shops (17.4%). The least important for them is the tenure option (9.83%), dwelling type (10.04%), and dwelling size (13.52%). The most significant type of respondents in this cluster are workers with medium income salaries (72.16%) and who use public transportation or a mix of public and private transportation (52.58%). This cluster also has the highest percentage of low-income workers relative to other clusters (27 out of 54 respondents). These types of respondents are consistent with the a priori hypothesis who consider distance to public transportation and housing cost the most and compensate (tradeoff) with the other attributes.

The fourth cluster includes 52 respondents (26% of the total sample). This cluster's most important attribute is dwelling size (31.22%), housing cost (17.28%), and distance to shops (16.33%). The aversion attribute is dwelling type (10.28%), tenure option (12.04%), and distance to public transportation (12.84%). The most significant type of respondents in this cluster are workers with medium income salaries (73.1%) and single households (65%). These kinds of respondents are medium-income workers who consider dwelling size as their greatest gain in utility, regardless of the dwelling type. More details of the characteristics of respondents and the attribute importance of each cluster can be examined in Appendix F.

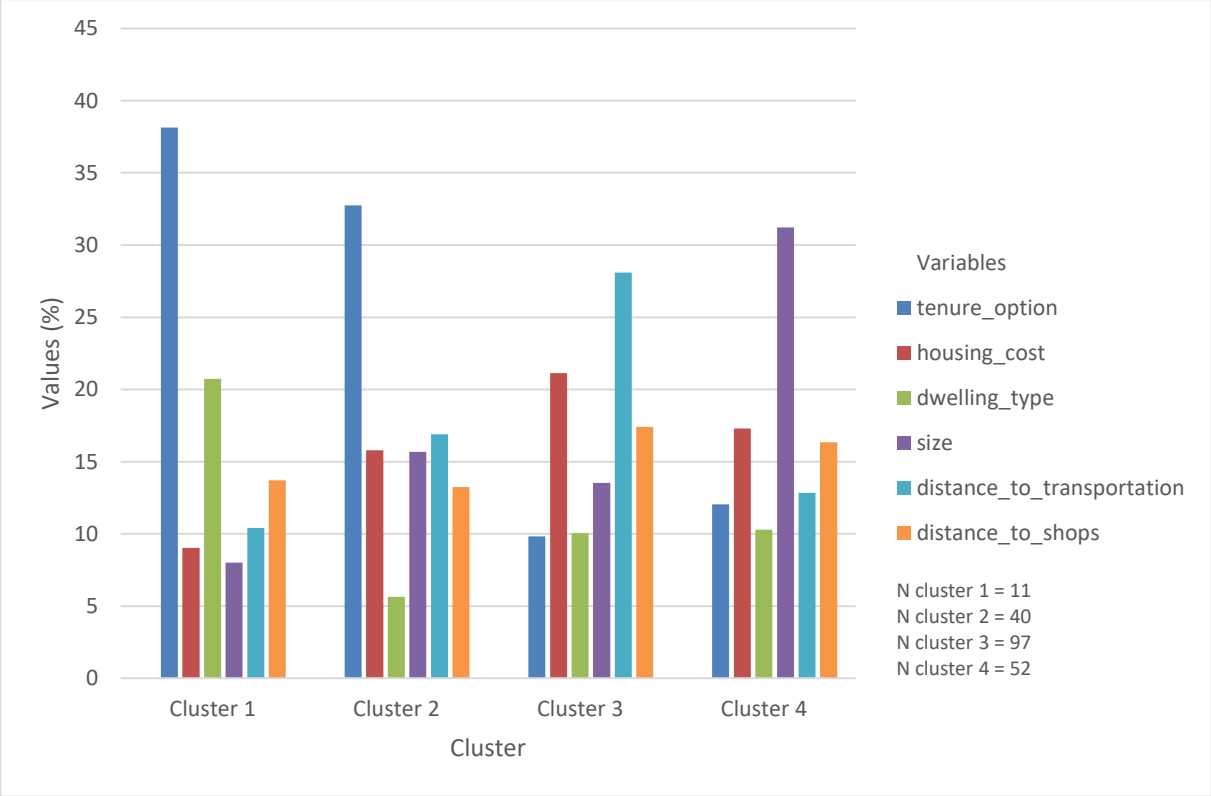


Figure 5. The attribute importance of each cluster

Examining the heterogeneity of housing preference using cluster analysis gives a broader perspective of workers' housing preferences. Different factors could lead to different preferences. The heterogeneity of housing preference is not only driven by income category but also by some other factors such as type of household and mobility habit (transportation mode used to the workplace). This analysis also provides bundles of housing characteristics that are preferred by the workers based on their socio-demographic characteristics. These two results combine may give better insight for developers to decide which attributes they should provide for different types of workers characteristics.

5. CONCLUSION

This study examines the housing preferences of workers in Jakarta. Six housing attributes, comprising tenure option, housing cost, dwelling type, dwelling size, distance to public transportation, and distance to shops, are examined. Using a fractional-factorial design of rating-based conjoint experiment, 16 housing profiles were constructed from the attributes and their levels. An online survey was delivered to respondents in Jakarta to obtain the conjoint data and was analyzed further using ordinary least squared (OLS) to estimate the contributions of the attributes and attribute levels.

The findings show that all housing attributes except dwelling type are found to be significant in determining the utility estimation. In general, an owner-occupied house is more preferred than a rental house, and a landed house is more favorable than an apartment. The housing preferences utility increases with decreasing housing cost, increasing size, and decreasing distance to shops. In addition, the most preferred distance to public transportation is 1 – 5 km. The workers consider distance to public transportation and housing cost as the most important attributes and compensate (tradeoff) with the other attributes. These results are confirming the first hypothesis.

The findings also confirm that housing preferences among workers differ depending on several factors such as income category, type of household, and mobility habit to work. The most important attributes for low-income workers are distance to public transportation and housing cost, while distance to public transportation and dwelling size are the most important for middle-income workers. The results of middle-income workers are confirming the second hypothesis. In addition, cluster analysis is used to examine the heterogeneity of the preferences further. The results show four clusters are significant in representing the housing characteristics and different socio-demographic conditions may affect individuals' housing preferences. These results also provide better insight for developers to decide which housing attributes should be emphasized to different conditions of workers.

Given the findings of this study, significant insight can be offered to the Jakarta Metropolitan Area policymakers and real estate developers. It might be wise for developers to consider building houses within a radius of 5 km from public transportation (such as Jabodetabek commuter train stations) at an affordable price. If the developers focus on the middle-income group, it would be better to also consider providing a bigger dwelling size in this specific location. The dwelling type can be both a landed house and an apartment. The developers might also need to focus on the owner-occupied market and avoid building houses that lack access to public transportation and shops.

Furthermore, it would be prudent for the national and local government to activate their land banking within a radius of 5 km from public transportation (such as Jabodetabek commuter train stations) in the Jakarta Metropolitan Area to balance the land price in this specific location. Thus, in regards to prior suggestions, this suggestion may help developers to deliver more affordable houses within this radius[4]. The local government might also need to consider regulating the land-use policies accordingly to allow more housing, shops, and mixed-use development within 5 km from public transportation. This suggestion may create more urban developments in the surrounding commuter train stations and bring more spaces for affordable housing that are close to the stations and accessible to shops and other amenities. The local government might also need to support the developers who want to provide more affordable houses within this radius by accelerating the issuance of building permits.

While this study provides valuable insights of the housing preferences of workers in Jakarta, this study has some limitations, and future research could investigate several areas that are not covered in this study. First, a limited number of housing attributes are included in this study. As has been mentioned in the methodology, rating-based conjoint could include up to nine housing attributes in the experiment. Future research should consider doing a preliminary survey to choose the housing attributes. This preliminary survey could give insights of the other attributes that may influence the housing preferences of workers. Second, cluster analysis indicates bundles of housing characteristics that are preferred by the workers based on their socio-demographic characteristics. Therefore, future research may need to focus on examining the preferences based on the demographic characteristics. Third, future research may need to examine which cities in the Jakarta Metropolitan Area are the most preferred by the workers. This research could give a better insight to the real estate developers for their future land acquisition.

[4] This suggestion may be useful to avoid the issue of high levels of vacancy that was introduced in section 1. This study shows that the bundles of housing attributes preferred by the workers are close to public transportation and have affordable cost/ price. However, the housing characteristics of the projects were either have an affordable price but far from the public transportation or close to the public transportation but more expensive (smaller units with affordable prices were limited to only 30% of the total units to make the project feasible to be built near the stations). Therefore, this suggestion may help developers to provide more houses with these preferred bundles of attributes.

REFERENCES

Bontje, M. (2016) “At home in Shenzhen? Housing opportunities andhousing preferences of creative workers in a wannabe creative city," *Creativity Studies*, 9(2), pp. 160-176, DOI: 10.3846/23450479.2016.1203832.

Bellhouse, D. R. (2007) "Sampling Methods: Exercises and Solutions," *The American Statistician*, 61(3), pp. 276–276. doi: 10.1198/tas.2007.s89.

BPS-Statistics of DKI Jakarta Province (2021) "DKI Jakarta Province in figures 2021". Retrieved from https://jakarta.bps.go.id/publication/2021/02/26/bb7fa6dd5e90b534e3fa6984/provinsi-dki-jakarta-dalam-angka-2021.html.

Clark, W. A. V. (2012) "Residential Mobility and the Housing Market". in DF Clapham, WAV Clark & K Gibb (eds), *The SAGE Handbook of Housing*. SAGE publications, London, pp. 66-83.

Colom, M. C. and Molés M. Cruz (2008) "Comparative Analysis of the Social, Demographic and Economic Factors That Influenced Housing Choices in Spain in 1990 and 2000," *Urban Studies*, 45(4), pp. 917–941.

Colliers (2021) "Property market report Q1 2021 Jakarta all sector". Retrieved from https://www.colliers.com/en-id/research/colliers-quarterly-property-market-report-q1-2021-jakarta-all-sector.

Coolen, H. C. C. H. and Jansen, S. J. T. (2012) "Housing preferences". in SJ Smith, M Elsinga, L Fox-O'Mahony, SE Ong & S Wachter (eds), *The International Encyclopedia of Housing and Home*. Elsevier, Oxford, pp. 606-612.

Cushman & Wakefield (2021) "Jakarta marketbeat reports". Retrieved from https://www.cushmanwakefield.com/en/indonesia/insights/jakarta-marketbeat.

Dol, K. and Boumeester, H. (2018) "Home Ownership Under Changing Labour and Housing Market Conditions: Tenure Preferences and Outcomes among Freelancers and Flex Workers," *International Journal of Housing Policy*, 18(3), pp. 355–382. doi: 10.1080/19491247.2017.1331594.

Elrod, T., Louviere, J. J. and Davey, K. S. (1992) "An Empirical Comparison of Ratings-Based and Choice-Based Conjoint Models," *Journal of Marketing Research*, 29(3), pp. 368–377.

Farasa, N. and Kusuma, H. E. (2018) "Housing Preferences of Young Adults in Indonesia: Housing Attributes and Consequences," *IOP Conference Series: Earth and Environmental Science*, 126, pp. 012184–012184. doi: 10.1088/1755-1315/126/1/012184.

Flickr.com (2016) “Jabodetabek urban rail network map (2020)”. Retrieved from: *https://www.flickr.com/photos/mbagasrw/29151154310*.

Idris, M. (2021) “Rincian UMR Jakarta 2021 dan daerah sekitarnya”, Kompas.com, 29 March. Available at: https://money.kompas.com/read/2021/03/29/164702726/rincian-umr-jakarta-2021-dan-daerah-sekitarnya#:~:text=JAKARTA%2C%20KOMPAS.com%20%2D%20Rincian,Rp%204.416.186%20per%20bulan. (19 April 2021).

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. (2010) *"Multivariate Data Analysis, 7th Edition"*. New York: Prentice Hall International, Inc.

Hoekman, R. P. (2019) *"Research into housing preferences of starters on the housing market: determine the most suitable locations in the Randstad for redevelop vacant non-residential buildings into starter dwellings based on the preferences of the starters on the housing market"*. Master thesis. Eindhoven University of Technology.

Hoshino, T. (2011) "Estimation and Analysis of Preference Heterogeneity in Residential Choice Behaviour," *Urban Studies*, 48(2), pp. 363–382.

Iswara, M. A. (2020) "Mortgage subsidies accessible to more citizens as Indonesia hit by pandemic", The Jakarta Post, 3 April. Available at: https://www.thejakartapost.com/news/2020/04/03/mortgage-subsidies-accessible-to-more-citizens-as-indonesia-hit-by-pandemic.html. (11 February 2021).

Jansen, S. J. T., Coolen, H. and Goetgeluk, R. W. (2011) *“The measurement and analysis of housing preference and choice”*. Dordrecht: Springer. doi:10.1007/978-90-481-8894-9.

Jakarta Provincial Government “Penyusunan rencana pembangunan dan pengembangan perumahan dan kawasan permukiman (RP3KP)”. Jakarta: PT. Hardja Moekti Consultant.

Kamyar H., Marketta K. and Greg B. (2019) "Beyond Housing Preferences: Urban Structure and Actualisation of Residential Area Preferences," *Urban Science*, 3(1). doi: 10.3390/urbansci3010021.

Kok, J. (2007) “Principles and Prospects of the Life Course Paradigm,” *Annales de Dėmographie Historique*, 1(1), pp. 203–230.

Lensen, A., Xue, B. and Zhang, M. (2017) “Using Particle Swarm Optimisation and the Silhouette Metric to Estimate the Number of Clusters, Select Features, and Perform Clustering,” *Open Access Victoria University of Wellington*. doi: https://doi.org/10.26686/wgtn.13058756.v1.

Mankila, M. (2004) "Retaining Students in Retail Banking through Price Bundling: Evidence from the Swedish Market," *European Journal of Operational Research*, 155(2), pp. 299–316. doi: 10.1016/S0377-2217(03)00088-2.

Ministry of Public Works (2015) “Konsep backlog”. Jakarta: PPDPP. Available at: https://ppdpp.id/konsep-backlog/. (19 May 2021).

Ministry of Public Works (2020) “Keputusan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 242/KPTS/M/2020”. Jakarta: Ministry of Public Works.

Molin, E.; Oppewal Harmen and Timmermans Harry. (1996) “Predicting consumer response to new housing: A stated choice experiment”, *Netherland Journal of Housing and the Built Environment*, 11(3), 297-311.

Molin, E., Oppewal, H. and Timmermans, H. (1997) "Modeling Group Preferences Using a Decompositional Preference Approach," *Group Decision and Negotiation*, 6(4), pp. 339–350. doi: 10.1023/A:1008612828114.

Moore, W. L. (2004) "A Cross-Validity Comparison of Rating-Based and Choice-Based Conjoint Analysis Models," *International Journal of Research in Marketing*, 21(3), pp. 299–312. doi: 10.1016/j.ijresmar.2004.01.002.

Mulder, C. H. and Hooimeijer, P. (1995) "Moving into Owner-Occupation: Compositional and Contextual Effects on the Propensity to Become a Homeowner," *Netherlands Journal of Housing and the Built Environment*, 10(1), pp. 5–25.

Mulder, C. H. and Wagner, M. (1998) "First-Time Home-Ownership in the Family Life Course: A West German-Dutch Comparison," *Urban Studies*, 35(4), pp. 687–713.

Nabila, M. (2019) “Kenapa sih, milenial susah membeli rumah?”, Bisnis.com, 21 November. Available at: https://ekonomi.bisnis.com/read/20191121/47/1172752/kenapa-sih-milenial-susah-membeli-rumah. (11 February 2021).

Nasution, D. D. (2019) “IPW: Supply-Demand perumahan masih timpang”, Republika.co.id, 13 May. Available at: https://republika.co.id/berita/prfy9l370/ipw-emsupplydemandem-perumahan-masih-timpang. (20 March 2021).

Okezone (2019) “Harga terus naik bikin milenial susah punya rumah”, okeFinance, 19 June. Available at: https://economy.okezone.com/read/2019/06/19/470/2068244/harga-terus-naik-bikin-milenial-susah-punya-rumah. (11 February 2021).

Opoku, R. A. and Abdul-Muhmin, A. G. (2010) "Housing Preferences and Attribute Importance among Low-Income Consumers in Saudi Arabia," *Habitat International*, 34(2), pp. 219–227. doi: 10.1016/j.habitatint.2009.09.006.

Perumnas (2020) “Realisasi penjualan 2020”. Jakarta: Sales division.

Popovic, M. et al. (2016) "Understanding Heterogeneity of Students' Preferences Towards English Medium Instruction: A Conjoint Analysis Approach," *Yugoslav Journal of Operations Research*, 26(1), pp. 91–102. doi: 10.2298/YJOR140915009P.

Ramadhani, Y. (2018) “Generasi milenial Jakarta lebih memilih huni kos daripada apartemen”, tirto.id, 6 September. Available at: https://tirto.id/generasi-milenial-jakarta-lebih-memilih-huni-kos-daripada-apartemen-cXiE. (19 April 2021).

RayWhite Indonesia (2021) “Tipe rumah berdasarkan luas bangunan update 2021”, raywhite.co.id. Available at: https://www.raywhite.co.id/news/105404tipe-tipe-rumah-berdasarkan-luas-bangunannya. (19 April 2021).

Rossi, P. H. (1955) *"Why families move: A study in the social psychology of urban residential mobility"*. 1st Edition. Glencoe: Free Press.

Robst, J., Deitz, R. and McGoldrick, K. M. (1999) "Income Variability, Uncertainty and Housing Tenure Choice," *Regional Science and Urban Economics*, 29(2), pp. 219–229. doi: 10.1016/S0166-0462(98)00031-3.

Sihombing, A. et al. (2019) "Interior Living Space Preferences in the Early Housing Career of Low-Income People in Dki Jakarta, Indonesia," *IOP Conference Series: Materials Science and Engineering*, 690, pp. 012024–012024. doi: 10.1088/1757-899X/690/1/012024.

Smits, A. and Mulder, C. H. (2008) "Family Dynamics and First-Time Homeownership," *Housing Studies*, 23(6), pp. 917–933. doi: 10.1080/02673030802416601.

Statistics Indonesia (2021) “Statistik komuter Jabodetabek”. Retrieved from https://www.bps.go.id/publication/2019/12/04/eab87d14d99459f4016bb057/statistik-komuter-jabodetabek-2019.html.

Sugianto, D. (2019) “Curhat kelas menengah tanggung, gaji ngepas susah beli rumah”, detikFinance, 4 August. Available at: https://finance.detik.com/properti/d-4651407/curhat-kelas-menengah-tanggung-gaji-ngepas-susah-beli-rumah. (11 February 2021).

Sulistyawati I et al. (2020) "Consumer Preference for Dried Mango Attributes: A Conjoint Study among Dutch, Chinese, and Indonesian Consumers," *Journal of food science*, 85(10), pp. 3527–3535. doi: 10.1111/1750-3841.15439.

Timmermans, H. J. P., Molin, E. J. E. and Noortwijk, van, L. E. (1994) "Housing Choice Processes : Stated Versus Revealed Modelling Approaches," *Netherlands Journal of Housing and the Built Environment*, 9(3), pp. 215–227.

Timmermans, H. J. P. et al. (1992) "Residential Choice Behaviour of Dual Earner Households: A Decompositional Joint Choice Model," *Environment and Planning A*, 24(4), pp. 517–533.

Tomaney, J. and Bradley, D. (2007) "The Economic Role of Mobile Professional and Creative Workers and Their Housing and Residential Preferences: Evidence from North East England," *The Town Planning Review*, 78(4), pp. 511–530.

van Ham, M. (2012a) "Economics of housing choice". in SJ Smith, M Elsinga, L Fox-O'Mahony, SE Ong & S Wachter (eds), *The International Encyclopedia of Housing and Home*. Elsevier, Oxford, pp. 42-46.

van Ham, M. (2012b) "Housing behaviour". in Clapham, D. F., Clark, W. A. and Gibb (eds), *The SAGE Handbook of Housing Studies*. SAGE Publications, London, pp. 47-65.

Vasanen, A. (2012) "Beyond Stated and Revealed Preferences: The Relationship between Residential Preferences and Housing Choices in the Urban Region of Turku, Finland," *Journal of Housing and the Built Environment*, 27(3), pp. 301–315.

Vectorstock.com "administrative map metropolitan Jakarta vector image". Retrieved from http://vectorstock.com/30320413.

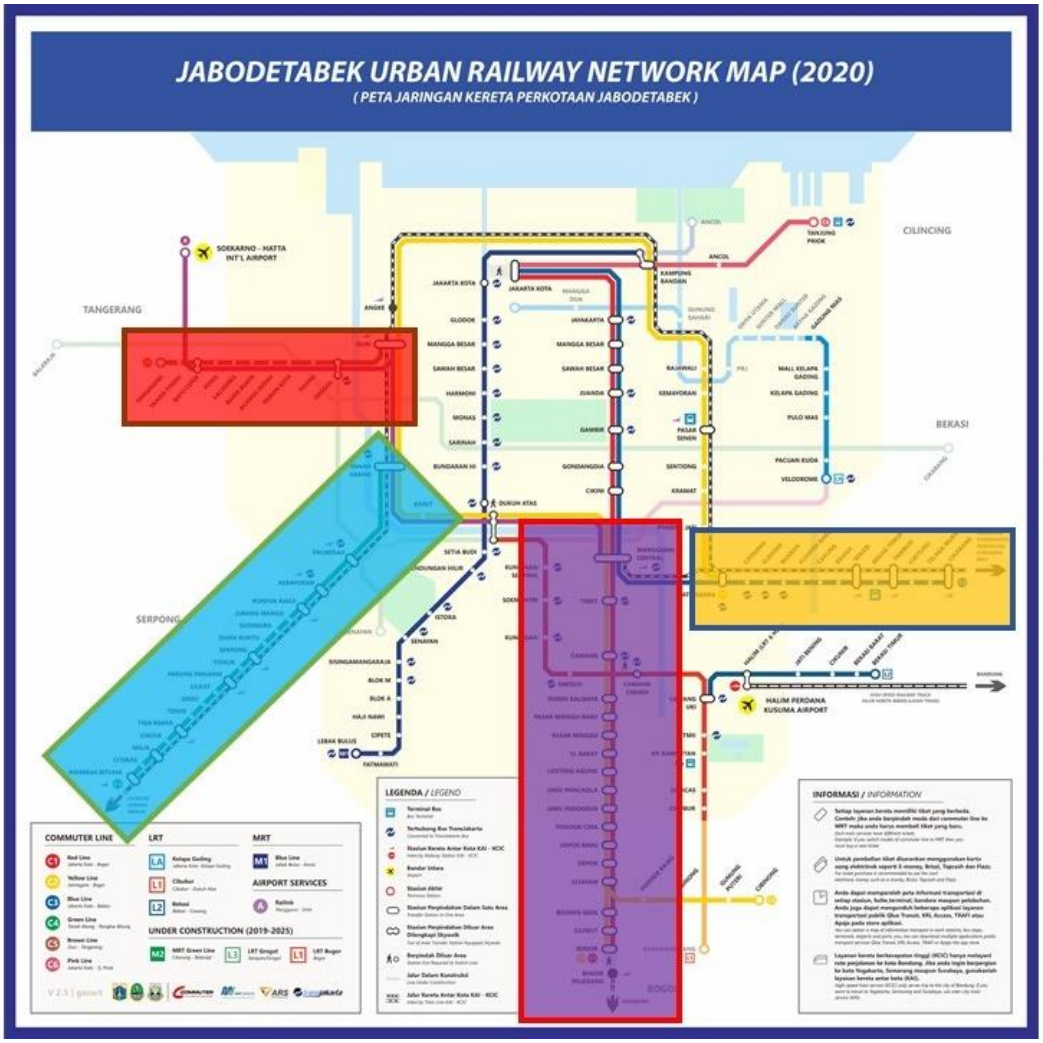
Vukic, M. et al. (2015) "Understanding the Heterogeneity of Generation Y's Preferences for Travelling: A Conjoint Analysis Approach," *International Journal of Tourism Research*, 17(5), pp. 482–491. doi: 10.1002/jtr.2015.

Wang, D. and Li, S.-M. (2004) "Housing Preferences in a Transitional Housing System: The Case of Beijing, China," *Environment and Planning A: Economy and Space*, 36(1), pp. 69–87. doi: 10.1068/a35263.

Zinas, B. Z. and Jusan, M. B. M. (2012) "Housing Choice and Preference: Theory and Measurement," *Procedia - Social and Behavioral Sciences*, 49, pp. 282–292. doi: 10.1016/j.sbspro.2012.07.026.

APPENDICES

APPENDIX A: Commuter Train Network



West line – connecting Tangerang City

Southwest line – connecting South Tangerang City, Bogor Regency, and Tangerang Regency

South line – connecting Depok City, Bogor Regency, and Bogor City

East line – connecting Bekasi City and Bekasi Regency

Source: Flickr.com (2016)

APPENDIX B: The Web-based Questionnaire

English

THE HOUSING PREFERENCE OF WORKERS IN JAKARTA

Dear respondent,
My name is Muhammad Hidayat Isa. I am an Indonesian student who is studying for a master's education at the University of Groningen in the Netherlands and currently doing my thesis with the title "The Housing Preference of Workers in Jakarta".

This study aims to analyze the housing preferences of workers in Jakarta. Specifically for middle to low-income workers who are not owning a house at the moment. By participating in this survey, you are contributed to help the government or other housing institutions to create a better housing policy in Jakarta and develop a better match housing supply in the future.

If you are willing to participate in this survey, it will take approximately 10 to 15 minutes to accomplish. I suggest you read the description carefully before you start to fill in your answer. Please complete the survey and fill in the answer according to your current state. All given answers are handled confidentially and only used for scientific purposes. For any further questions, please kindly contact me through email: m.h.isa@student.rug.nl.

Kind regards,
Muhammad Hidayat Isa

I am willing to take this survey ○

I do not want to continue this survey ○

university of groningen

English

Part 1: Preliminary question

In this section, you will answer some preliminary questions to get the eligible respondent for this study. If you finish this section, it means that you are eligible for this survey and are allowed to continue. However, if you choose your answer and the survey automatically ends, it means that you are not eligible to continue this survey. Thank you for your participation.

Are you working in Jakarta?

- ○ Yes
- ○ No

Are you owning a house?

- ○ Yes
- ○ No

How much do you earn per month?

- ○ ≤ Rp 8 million
- ○ > Rp 8 million

university of groningen

English

Part 2: Socio-demographic condition

The second section contains the socio-demographic questions. Please complete all the questions correctly.

I am ... years old

Sex

- Male
- Female

Marriage status and household state

- Single
- Married, without child
- Married, with child(ren)
- Divorced, without child
- Divorced, with child(ren)

Type of occupation

- Flex (freelance)
- Temporary contract
- Permanent contract

Salary per month

- ≤ Rp 5 million
- > Rp 5 million - Rp 8 million

How long have you been working?

- < 2 years
- 2 - 5 years
- > 5 years

Number of income earners in the household

- Single earner
- Dual earners

Transportation mode to work

- Private vehicle
- Public transportation
- Mix of private vehicle and public transportation

university of groningen

English

Part 3: Housing preference experiment

The third section is the housing preference experiment. You will evaluate sixteen different housing profiles and give a scale from 0 (if the housing profile is extremely unattractive) to 10 (if the housing profile is extremely attractive). Each housing profile contains 6 different characteristics with indicated values. Please take your time to understand the characteristics of each housing profile before you give your answer. The characteristics and indicated value are shown below:

Housing characteristics	Indicated value	Description
Tenure option	Rental houses Owner-occupied houses	Preferred tenure option
Housing cost	< Rp2 million Rp2 million – Rp3 million > Rp3 million	Housing monthly cost in Indonesian Rupiah (Rp)
Dwelling type	Landed house Apartment	Type of housing
Size	21 m2 (studio) 27 m2 (1 bedroom) 36 m2 (2 bedrooms)	Total floor area in m^2. A studio-style house is typically consisting of one large room that serves as the combined bedroom, living, dining, and one bathroom.
Distance to public transportation	< 1 km 1 - 5 km > 5 km	Distance to the closest public transportation in km (station, bus stop, etc.)
Distance to shops	< 1 km 1 - 5 km > 5 km	Distance to the closest shops in km (supermarket, shopping center or mall, etc.)

Some profiles are provided with an existing example to give a better understanding of evaluating the housing profile. In some profiles, however, the existing example is not available, and please evaluate based on the housing profile description. **The example of housing profiles, the existing example, and the answers are shown below:**

Profile 1:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	Rp 2 million - Rp 3 million
Dwelling type	Landed house
Size	36 m2 (2 bedrooms)
Distance to public transport	< 1 km
Distance to shops	< 1 km

Existing example:

Renting a 36 type house with 2 bedrooms in nearby Kranji Station, Bekasi City.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ● ○ ○ ○ ○

Profile 5:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	Rp 2 million - Rp 3 million
Dwelling type	Apartment
Size	21 m2 (studio)
Distance to public transport	1 - 5 km
Distance to shops	> 5 km

Existing example:

The researcher did not find any existing examples of this profile in the Jabodetabek area.

Please evaluate the housing profile based on the description.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

○ ○ ○ ● ○ ○ ○ ○ ○ ○ ○

I understand, continue this survey

○

university of groningen

English

Evaluation procedure:
You will evaluate sixteen different housing profiles and give a scale from 0 (if the housing profile is extremely unattractive) to 10 (if the housing profile is extremely attractive). Each housing profile contains 6 different characteristics with indicated values. Please take your time to understand the characteristics of each housing profile before you give your answer. The characteristics and indicated value are shown below:

Housing characteristics	Indicated value	Description
Tenure option	Rental houses Owner-occupied houses	Preferred tenure option
Housing cost	< Rp2 million Rp2 million – Rp3 million > Rp3 million	Housing monthly cost in Indonesian Rupiah (Rp)
Dwelling type	Landed house Apartment	Type of housing
Size	21 m2 (studio) 27 m2 (1 bedroom) 36 m2 (2 bedrooms)	Total floor area in m^2. A studio-style house is typically consisting of one large room that serves as the combined bedroom, living, dining, and one bathroom.
Distance to public transportation	< 1 km 1 - 5 km > 5 km	Distance to the closest public transportation in km (station, bus stop, etc.)
Distance to shops	< 1 km 1 - 5 km > 5 km	Distance to the closest shops in km (supermarket, shopping center or mall, etc.)

Profile 1:
On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	Rp 2 million - Rp 3 million
Dwelling type	Landed house
Size	36 m2 (2 bedrooms)
Distance to public transport	< 1 km
Distance to shops	< 1 km

Existing example:
Renting a 36 type house with 2 bedrooms in nearby Kranji Station, Bekasi City.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 2:
On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	< Rp 2 million
Dwelling type	Landed house
Size	27 m2 (1 bedroom)
Distance to public transport	> 5 km
Distance to shops	> 5 km

Existing example:
Renting a 27 type house with 1 bedroom in the western part of Bogor Regency (around Dramaga to Cibungbulang region).

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 3:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	< Rp 2 million
Dwelling type	Apartment
Size	27 m2 (1 kamar tidur)
Distance to public transport	1 - 5 km
Distance to shops	< 1 km

Existing example:

Renting an affordable one-bedroom apartment in Kemayoran, North Jakarta.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 4:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	< Rp 2 million
Dwelling type	Apartment
Size	21 m2 (studio)
Distance to public transport	< 1 km
Distance to shops	1 - 5 km

Existing example:

Renting a studio apartment in Margonda, Depok City.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 5:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	Rp 2 million - Rp 3 million
Dwelling type	Apartment
Size	21 m2 (studio)
Distance to public transport	1 - 5 km
Distance to shops	> 5 km

Existing example:

The researcher did not find any existing examples of this profile in the Jabodetabek area. Please evaluate the housing profile based on the description.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 6:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	< Rp 2 million
Dwelling type	Landed house
Size	36 m2 (2 bedrooms)
Distance to public transport	1 - 5 km
Distance to shops	< 1 km

Existing example:

The researcher did not find any existing examples of this profile in the Jabodetabek area. Please evaluate the housing profile based on the description.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 7:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	> Rp 3 million
Dwelling type	Apartment
Size	27 m2 (1 bedroom)
Distance to public transport	< 1 km
Distance to shops	< 1 km

Existing example:

Owning and living in a one-bedroom apartment that integrates into Pondok Cina station, Depok, and facing Margo City Mall.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 8:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	Rp 2 million Rp 3 million
Dwelling type	Landed house
Size	27 m2 (1 bedroom)
Distance to public transport	< 1 km
Distance to shops	1 - 5 km

Existing example:

Owning and living in a 27 type house with 1 bedroom in nearby Parung Panjang station, Bogor.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 9:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	> Rp 3 million
Dwelling type	Landed house
Size	21 m2 (studio)
Distance to public transport	1 - 5 km
Distance to shops	1 - 5 km

Existing example:

Renting an exclusive studio bedroom accommodation in the South Jakarta region.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 10:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	> Rp 3 million
Dwelling type	Apartment
Size	36 m2 (2 bedrooms)
Distance to public transport	< 1 km
Distance to shops	> 5 km

Existing example:

The researcher did not find any existing examples of this profile in the Jabodetabek area. Please evaluate the housing profile based on the description.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 11:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	< Rp 2 million
Dwelling type	Landed house
Size	21 m2 (studio)
Distance to public transport	< 1 km
Distance to shops	> 5 km

Existing example:

Owning and living in a 21 type house in nearby Daru station, Tangerang.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 12:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	< Rp 2 million
Dwelling type	Apartment
Size	21 m2 (studio)
Distance to public transport	< 1 km
Distance to shops	< 1 km

Existing example:

Owning and living in a subsidized studio apartment that integrates into Pondok Cina station Depok, and facing Margo City Mall.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 13:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	> Rp 3 million
Dwelling type	Landed house
Size	21 m2 (studio)
Distance to public transport	> 5 km
Distance to shops	< 1 km

Existing example:

Owning and living in a 21 type house in the Northern part of Bekasi City.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 14:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	Rp 2 million - Rp 3 million
Dwelling type	Apartment
Size	21 m2 (studio)
Distance to public transport	> 5 km
Distance to shops	< 1 km

Existing example:

Renting a studio apartment in Kelapa Dua, Tangerang City.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 15:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Owner-occupied house
Housing cost per month	< Rp 2 million
Dwelling type	Apartment
Size	36 m2 (2 bedrooms)
Distance to public transport	> 5 km
Distance to shops	1 - 5 km

Existing example:

The researcher did not find any existing examples of this profile in the Jabodetabek area. Please evaluate the housing profile based on the description.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

Profile 16:

On a scale of 0-10, how attractive the housing profile is to you?

Tenure option	Rental house
Housing cost per month	< Rp 2 million
Dwelling type	Landed house
Size	21 m2 (studio)
Distance to public transport	< 1 km
Distance to shops	< 1 km

Existing example:

Renting a 21 type house in nearby Parung Panjang station, Bogor.

Extremely unattractive — Extremely attractive

0 1 2 3 4 5 6 7 8 9 10

← →

APPENDIX C: Descriptive statistics log file in StataSE 16

```
**Descriptive statistic thesis

clear all


**directory

cd"C:\Users\Muhammad Hidayat Isa\Documents\Real Estate Studies Groningen\Master Thesis Class\Master Thesis\Data\Conjoint\Final Data 3 Juni\STATA"


**smoothly run the code

set more off


**dataset

import excel preferensi_rumah_jakarta_excel.xlsx, firstrow case(lower)


**save dataset raw

save "dataset_raw.dta", replace


**edit dataset

drop ipaddress

drop recipientlastname-userlanguage

drop if status == "Survey Preview"
```

```
**save dataset

use "preferensi_dataset.dta", replace


**description

sum

drop if willingness_survey == "I do not want to continue this survey"

drop if working_in_jakarta == "No"

drop if owning_house == "Yes"

drop if earnings == "> Rp 8 million"

drop if progress < 100

sum


**descriptive statistic

summarize age

summarize age if salary == "> Rp 5 million to Rp 8 million"

summarize age if salary == "≤ Rp 5 million"

tabulate sex

tabulate sex if salary == "> Rp 5 million to Rp 8 million"

tabulate sex if salary == "≤ Rp 5 million"

tabulate marriage_status

tabulate marriage_status if salary == "> Rp 5 million to Rp 8 million"

tabulate marriage_status if salary == "≤ Rp 5 million"

tabulate type_occupation
```

```
tabulate type_occupation if salary == "> Rp 5 million to Rp 8 million"

tabulate type_occupation if salary == "≤ Rp 5 million"

tabulate salary

tabulate salary if salary == "> Rp 5 million to Rp 8 million"

tabulate salary if salary == "≤ Rp 5 million"

tabulate working_years

tabulate working_years if salary == "> Rp 5 million to Rp 8 million"

tabulate working_years if salary == "≤ Rp 5 million"

tabulate number_earners

tabulate number_earners if salary == "> Rp 5 million to Rp 8 million"

tabulate number_earners if salary == "≤ Rp 5 million"

tabulate transportation_mode

tabulate transportation_mode if salary == "> Rp 5 million to Rp 8 million"

tabulate transportation_mode if salary == "≤ Rp 5 million"
```

APPENDIX D: Rating-based conjoint syntax code in IBM SPSS statistics 27

```
CONJOINT PLAN= 'C:\Users\Muhammad Hidayat Isa\Documents\Real Estate Studies Groningen\Master Thesis Class\Master Thesis\Data\Conjoint\Final Data 3 Juni\Conjoint\Housing_Profile_Final.sav'

/DATA= 'C:\Users\Muhammad Hidayat Isa\Documents\Real Estate Studies Groningen\Master Thesis Class\Master Thesis\Data\Conjoint\Final Data 3 Juni\Conjoint\conjoint_all.sav'

/SCORE=P1 TO P16

/SUBJECT=Responden

/FACTORS=tenure_option housing_cost dwelling_type size distance_to_transport distance_to_shops

/PRINT= ALL
```

APPENDIX E: Summary of choice simulators

Low-income					Middle-income					Middle-income				
	Scenario 1		Scenario 2			Scenario 1		Scenario 2			Scenario 1		Scenario 2	
Responden	Profile 1	Profile 2	Profile 1	Profile 2	Responden	Profile 1	Profile 2	Profile 1	Profile 2	Responden	Profile 1	Profile 2	Profile 1	Profile 2
1	0	1	0	1	3	1	0	1	0	76	1	0	1	0
2	1	0	1	0	4	1	0	1	0	77	1	0	1	0
3	1	0	1	0	5	1	0	1	0	78	1	0	1	0
4	1	0	1	0	6	0	1	1	0	79	1	0	1	0
5	1	0	1	1	7	1	0	1	0	80	1	0	1	0
6	1	0	1	0	8	1	0	1	0	81	1	0	1	0
7	1	0	1	0	9	1	0	1	0	82	1	0	1	0
8	1	0	1	0	10	1	0	1	0	83	1	0	1	0
9	1	0	1	0	11	1	0	1	0	84	1	0	1	0
10	1	0	1	0	12	0	1	1	0	85	0	1	0	1
11	1	0	1	0	13	1	0	1	0	86	1	0	1	0
12	1	0	1	0	14	0	1	1	0	87	1	0	1	0
13	1	0	1	0	15	0	1	1	0	88	1	0	1	0
14	1	0	1	0	16	1	0	1	0	89	1	0	1	0
15	0	1	1	0	17	0	1	1	0	90	1	0	1	0
16	1	0	1	0	18	1	0	1	0	91	0	1	1	0
17	1	1	1	0	19	1	0	1	0	92	1	0	1	0
18	0	1	1	0	20	1	0	1	0	93	1	0	0	1
19	1	0	1	0	21	1	0	1	0	94	1	0	1	0
20	1	0	1	0	22	1	0	1	0	95	1	0	1	0
21	1	0	1	0	23	1	0	1	0	96	1	0	1	0
22	1	0	1	0	24	1	0	1	0	97	1	0	1	0
23	1	0	1	0	25	1	0	1	0	98	1	0	1	0
24	1	0	1	0	26	0	1	1	0	99	1	0	1	0
25	1	0	1	0	27	1	0	1	0	100	1	0	1	0
26	1	0	1	0	28	1	0	1	0	101	1	0	1	0
27	1	0	1	0	29	1	0	1	0	102	1	0	1	0
28	1	0	1	0	30	1	0	1	0	103	1	0	1	0
29	1	0	1	0	31	1	0	1	0	104	1	0	1	0
30	1	0	1	1	32	1	1	1	0	105	0	1	1	0
31	0	1	0	1	33	0	1	1	0	106	1	0	1	0
32	1	1	0	1	34	0	1	1	0	107	1	0	1	0
33	1	0	1	0	35	1	0	1	0	108	0	1	0	1
34	1	0	1	0	36	1	0	1	0	109	1	0	1	0
35	1	0	1	0	37	1	0	1	0	110	1	0	1	0
36	1	0	1	0	38	1	0	1	0	111	1	0	1	0
37	1	0	1	0	39	1	0	1	0	112	1	0	1	0
38	1	0	1	0	40	1	0	1	0	113	1	0	1	0
39	1	0	1	0	41	1	0	1	0	114	1	0	1	0
40	1	0	1	0	42	1	0	1	0	115	1	0	1	0
41	1	0	1	0	43	1	0	1	0	116	1	0	1	0
42	1	0	1	0	44	1	0	1	0	117	1	0	1	0
43	1	0	0	1	45	1	0	1	0	118	1	0	0	1
44	1	0	1	0	46	1	0	1	0	119	1	1	1	0
45	0	1	0	1	47	1	0	1	0	120	1	0	1	0
46	1	0	1	0	48	1	0	1	0	121	0	1	1	0
47	0	1	0	1	49	1	0	1	0	122	1	0	1	0
48	1	0	1	0	50	1	0	1	0	123	1	0	1	0
49	0	1	1	0	51	1	0	1	0	124	1	0	1	0
50	1	0	1	0	52	0	1	0	1	125	1	0	1	0
51	1	0	1	0	53	1	1	1	0	126	1	0	0	1
52	0	1	0	1	54	0	1	1	0	127	1	0	0	1
53	1	0	1	0	55	1	0	1	0	128	1	0	1	0
54	0	1	0	1	56	1	0	1	1	129	1	0	1	0
Total	45	11	46	10	57	1	0	1	0	130	1	0	1	0
%	80.36%	19.64%	82.14%	17.86%	58	1	0	1	0	131	1	0	1	0
					59	1	0	0	1	132	1	0	1	0
					60	1	0	1	0	133	1	0	1	0
					61	1	0	1	0	134	1	0	1	0
					62	0	1	0	1	135	1	0	1	0
					63	1	0	1	0	136	1	0	1	0
					64	1	0	1	0	137	1	0	1	0
					65	0	1	0	1	138	1	0	1	0
					66	1	0	1	0	139	1	0	1	0
					67	1	0	1	0	140	0	1	1	0
					68	1	0	1	0	141	1	0	1	0
					69	0	1	1	0	142	1	0	1	0
					70	1	0	1	0	143	1	0	1	0
					71	1	0	1	0	144	1	0	1	0
					72	1	1	1	1	145	1	0	1	0
					73	1	0	1	0	146	1	0	1	0
					74	1	0	1	0	147	1	0	1	0
					75	1	0	1	0	148	1	0	1	0
										Total	127	23	136	12
										%	84.67%	15.33%	91.89%	8.11%

Note: 1 = choosing, 0 = not choosing

APPENDIX F: Cluster analysis output

1. ANOVA table of cluster analysis

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
tenure_option	7023.705	3	52.359	196	134.146	.000
housing_cost	673.942	3	73.247	196	9.201	.000
dwelling_type	676.513	3	52.258	196	12.946	.000
size	4113.867	3	54.929	196	74.895	.000
distance_to_transportation	3415.305	3	68.180	196	50.093	.000
distance_to_shops	185.441	3	60.013	196	3.090	.028

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

2. Attribute importance each cluster

Final Cluster Centers

	Cluster			
	1	2	3	4
tenure_option	38.14	32.76	9.83	12.04
housing_cost	9.03	15.78	21.12	17.28
dwelling_type	20.74	5.63	10.04	10.28
size	7.99	15.68	13.52	31.22
distance_to_transportation	10.39	16.91	28.09	12.84
distance_to_shops	13.71	13.24	17.40	16.33

3. Socio-demographic condition of cluster 1

Variable	Obs	Mean	Std. Dev.	Min	Max
age	11	27.81818	3.709938	22	35

sex	Freq.	Percent	Cum.
Female	6	54.55	54.55
Male	5	45.45	100.00
Total	11	100.00	

marriage_status	Freq.	Percent	Cum.
Married, with child(ren)	4	36.36	36.36
Married, without child	1	9.09	45.45
Single	6	54.55	100.00
Total	11	100.00	

type_occupation	Freq.	Percent	Cum.
Flex (freelance)	1	9.09	9.09
Permanent contract	6	54.55	63.64
Temporary contract	4	36.36	100.00
Total	11	100.00	

salary	Freq.	Percent	Cum.
> Rp 5 million to Rp 8 million	6	54.55	54.55
≤ Rp 5 million	5	45.45	100.00
Total	11	100.00	

working_years	Freq.	Percent	Cum.
2 - 5 years	4	36.36	36.36
< 2 years	3	27.27	63.64
> 5 years	4	36.36	100.00
Total	11	100.00	

number_earners	Freq.	Percent	Cum.
Dual earners	3	27.27	27.27
Single earner	8	72.73	100.00
Total	11	100.00	

transportation_mode	Freq.	Percent	Cum.
Mix of private vehicle and public tra..	1	9.09	9.09
Private vehicle	8	72.73	81.82
Public transportation	2	18.18	100.00
Total	11	100.00	

4. Socio-demographic condition of cluster 2

Variable	Obs	Mean	Std. Dev.	Min	Max
age	40	27.875	4.729544	20	39

sex	Freq.	Percent	Cum.
Female	20	50.00	50.00
Male	20	50.00	100.00
Total	40	100.00	

marriage_status	Freq.	Percent	Cum.
Married, with child(ren)	10	25.00	25.00
Married, without child	4	10.00	35.00
Single	26	65.00	100.00
Total	40	100.00	

type_occupation	Freq.	Percent	Cum.
Flex (freelance)	3	7.50	7.50
Permanent contract	22	55.00	62.50
Temporary contract	15	37.50	100.00
Total	40	100.00	

salary	Freq.	Percent	Cum.
> Rp 5 million to Rp 8 million	32	80.00	80.00
≤ Rp 5 million	8	20.00	100.00
Total	40	100.00	

working_years	Freq.	Percent	Cum.
2 - 5 years	17	42.50	42.50
< 2 years	14	35.00	77.50
> 5 years	9	22.50	100.00
Total	40	100.00	

number_earners	Freq.	Percent	Cum.
Dual earners	11	27.50	27.50
Single earner	29	72.50	100.00
Total	40	100.00	

transportation_mode	Freq.	Percent	Cum.
Mix of private vehicle and public tra..	10	25.00	25.00
Private vehicle	20	50.00	75.00
Public transportation	10	25.00	100.00
Total	40	100.00	

5. Socio-demographic condition of cluster 3

Variable	Obs	Mean	Std. Dev.	Min	Max
age	97	26.95876	5.537594	2	53

sex	Freq.	Percent	Cum.
Female	54	55.67	55.67
Male	43	44.33	100.00
Total	97	100.00	

marriage_status	Freq.	Percent	Cum.
Divorced, with child(ren)	1	1.03	1.03
Married, with child(ren)	15	15.46	16.49
Married, without child	16	16.49	32.99
Single	65	67.01	100.00
Total	97	100.00	

type_occupation	Freq.	Percent	Cum.
Flex (freelance)	7	7.22	7.22
Permanent contract	62	63.92	71.13
Temporary contract	28	28.87	100.00
Total	97	100.00	

salary	Freq.	Percent	Cum.
> Rp 5 million to Rp 8 million	70	72.16	72.16
≤ Rp 5 million	27	27.84	100.00
Total	97	100.00	

working_years	Freq.	Percent	Cum.
2 - 5 years	44	45.36	45.36
< 2 years	34	35.05	80.41
> 5 years	19	19.59	100.00
Total	97	100.00	

number_earners	Freq.	Percent	Cum.
Dual earners	27	27.84	27.84
Single earner	70	72.16	100.00
Total	97	100.00	

transportation_mode	Freq.	Percent	Cum.
Mix of private vehicle and public tra..	20	20.62	20.62
Private vehicle	46	47.42	68.04
Public transportation	31	31.96	100.00
Total	97	100.00	

6. Socio-demographic condition of cluster 4

Variable	Obs	Mean	Std. Dev.	Min	Max
age	52	27.82692	3.889257	22	43

sex	Freq.	Percent	Cum.
Female	27	51.92	51.92
Male	25	48.08	100.00
Total	52	100.00	

marriage_status	Freq.	Percent	Cum.
Divorced, without child	2	3.85	3.85
Married, with child(ren)	11	21.15	25.00
Married, without child	6	11.54	36.54
Single	33	63.46	100.00
Total	52	100.00	

type_occupation	Freq.	Percent	Cum.
Flex (freelance)	4	7.69	7.69
Permanent contract	28	53.85	61.54
Temporary contract	20	38.46	100.00
Total	52	100.00	

salary	Freq.	Percent	Cum.
> Rp 5 million to Rp 8 million	38	73.08	73.08
≤ Rp 5 million	14	26.92	100.00
Total	52	100.00	

working_years	Freq.	Percent	Cum.
2 - 5 years	26	50.00	50.00
< 2 years	15	28.85	78.85
> 5 years	11	21.15	100.00
Total	52	100.00	

number_earners	Freq.	Percent	Cum.
Dual earners	17	32.69	32.69
Single earner	35	67.31	100.00
Total	52	100.00	

transportation_mode	Freq.	Percent	Cum.
Mix of private vehicle and public tra..	8	15.38	15.38
Private vehicle	31	59.62	75.00
Public transportation	13	25.00	100.00
Total	52	100.00	