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Median Multiple Affordability: Use and considerations

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Introduction

There are many indicators that measure housing affordability, where their calculations vary depending on the objective. One indicator that is commonly used to measure affordability within the market is the 'median multiple'. As the name implies, it is a ratio between two medians—median house price and median household income.

This article elaborates about the 'median multiple'; what it is, what it is not, as well as additional considerations that need to be made when using the measure.

Views are short opinion pieces by the author(s) to encourage the exchange of ideas on current issues. They may not necessarily represent the official views of KRI. All errors remain the authors' own.

This view was prepared by Puteri Marjan Megat Muzafar and Theebalakshmi Kunasekaran, researchers from the Khazanah Research Institute (KRI). The authors are grateful for the valuable comments from from Dr Suraya Ismail and Gregory Ho Wai Son.

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"If there is a single indicator that conveys the greatest amount of information on the overall performance of housing markets, it is the house price-to-income ratio. It is obviously a key measure of housing affordability. When housing prices are high relative to incomes, other things being equal, a smaller fraction of the population will be able to purchase housing."

The Housing Indicators Program, 1990,
A joint program of the United Nations Centre for Human Settlements and the World Bank[1]

How the median multiple is measured and why it is important

The attractiveness of median multiple as a measure is the simplicity of the calculation. To get the median multiple of a country, take the median free-market house price, then divide it with the annual median household income (gross). The median is used, rather than the average, because the median is unaffected when the distribution of household income or house prices are skewed—such as the existence of high-income households or luxury housing.

For example in 2019, Malaysia's median house price was RM289,646, and the median household income was RM5,873. To get the median multiple, divide RM289,646 by the annual income of RM70,476, which equals to 4.1.

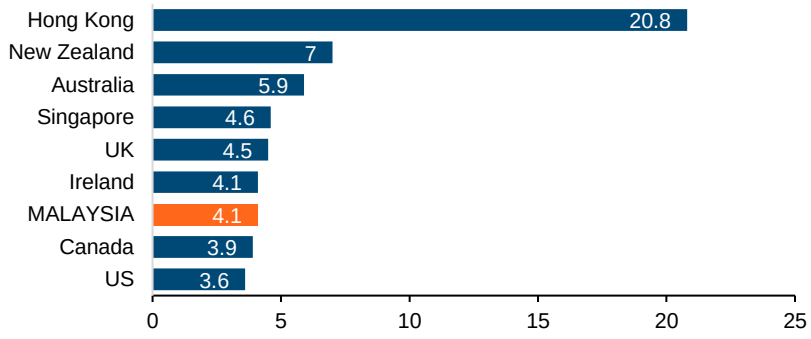
To understand what the number 'indicates', the median multiple can be grouped into four affordability categories (see Table 1). A median multiple of 3 and below signals that the housing market of an area is affordable. Figure 1 shows how the median multiple varies globally—Hong Kong being the most unaffordable at a ratio of 20.8. A more granular analysis would show how housing market performs differently, even within countries. For instance Cleveland scored 2.7 (affordable), while San Francisco scored 8.4 (severely unaffordable), showcasing the different housing market in the United States[2].

Table 1: Categories of affordability

Affordability category
5.1 & above Severely unaffordable
4.1 to 5.0 Seriously unaffordable
3.1 to 4.0 Moderately unaffordable
3.0 and below Affordable

Source: Demographia (2020)

Figure 1: International comparison of market's housing affordability, 2019



Source: Demographia (2020), NAPIC (n.d.), DOS (2020), authors' calculations

To see what the median multiple would like for the Malaysian market, we simulated it based on the median household income of RM 5,873 (see Figure 2). It shows how a low median multiple of

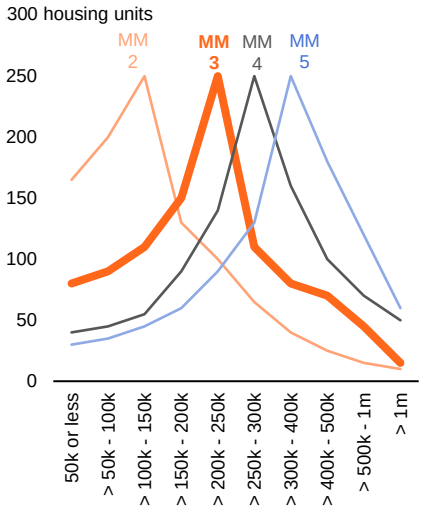
[1] Angel et al. (1993)
[2] Demographia (2020)

2 signals house prices that is skewed to the left, while a high median multiple (4 and 5) is skewed to the right.

Figure 3 shows Malaysia's household distribution by income class in 2019. If we compare Figure 2 and 3, a housing supply with a median multiple of 3 appears more in line with the distribution of household income. Indeed, the signal of a well-functioning housing market is when most prospective buyers can afford to buy a house irrespective of their income level[3].

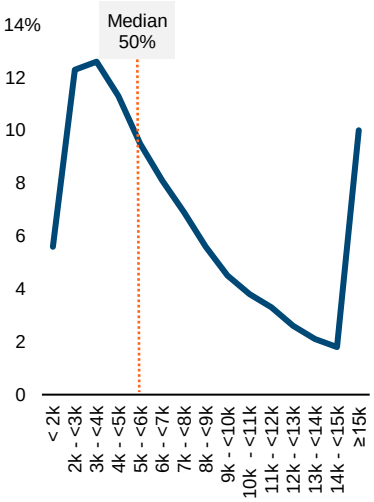
Malaysia's median multiple in 2019 was 4.1, placing us in the 'seriously unaffordable category. If we chart it across time, the ratio indicates that Malaysia's housing market has always been unaffordable (see Figure 4).

Figure 2: Simulation for median multiple of 2, 3, 4, and 5



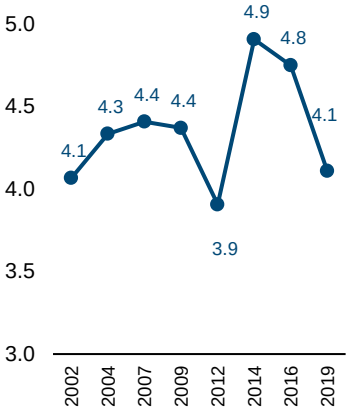
Note: For this simulation, the total number of units transacted is 1,000.
Source: NAPIC (2020), authors' calculations

Figure 3: Distribution of households by income class, 2019



Source: DOS (2020)

Figure 4: Median multiple affordability, 2002 - 2019



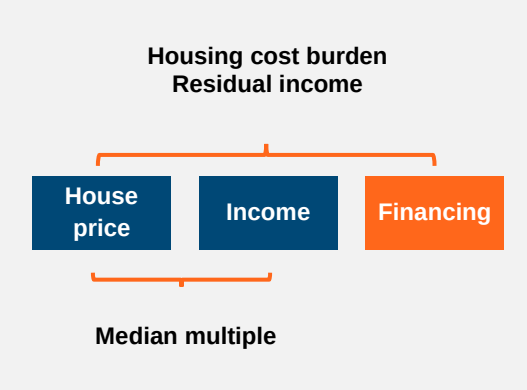
Source: NAPIC (2020), DOS (2020), Suraya Ismail et al. (2019), authors' calculations

It asseses housing affordability based on house price and income variations, and does not include the role of financing

It is important to note that the median multiple isolates the role of financing in its calculations, and only accounts house price and income (see Figure 5). Other commonly used housing affordability measures, such as housing cost burden and residual incomes include financing elements—hence the ability of households to purchase a home is based on the housing loan they can qualify for[4].

[3] Suraya Ismail and Gregory Ho Wai Son (2021)
[4] Suraya Ismail et al. (2019)

Figure 5: Common elements of home buyer's affordability measures



Source: Authors' illustration

Table 2: Three common housing affordability indicators

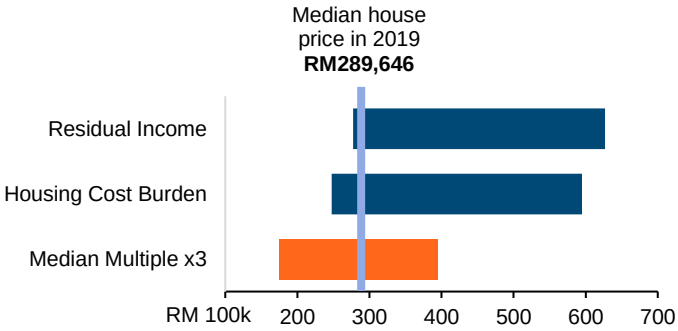
Approach	Definition
Housing cost burden	The housing cost burden approach caps the total housing cost (e.g. rent or mortgage) at 30% of the household income
Residual income	The residual income refers to the remaining household income after deducting non-housing related expenditure. It is used to estimate the maximum housing loan that can be attained by households.
Median multiple approach	Ratio of median house price to median gross annual income. Median multiple of 3.0 and below signals an affordable housing market.

Source: BNM (2016)

Among the problems with including financing in measuring housing affordability is that it is often not well understood beyond the financial sector[5]. The ability to afford a home loan (also called mortgage affordability) is dependent on the amount required for downpayment, the duration of loan period and the interest rates (which changes across the loan period). For example, an RM300k house may appear 'unaffordable' with a 10-years loan, but can appear 'affordable' with a 30-years loan, based on lower monthly repayments. During recessions, high-priced houses can suddenly be 'affordable' due to lower interest rates.

Another issue with including financing in measuring affordability is that it has the tendency to skew house prices higher[6]. To test this, we calculated the house price range that can be afforded by Middle 40 households (M40) for the three affordability indicators (Figure 6). It is seen that the house prices deemed affordable by both housing cost burden and residual income approach are skewed to the right, surpassing the actual median price of home sales in 2019.

Figure 6: Comparison of housing affordability measures, 2019



Affordability Indicator	Price range (RM)
M40 Income level	4,850 – 10,959
Residual Income	277,502 – 349,321
Housing Cost Burden	247,500 – 347,323
Median Multiple	174,600 – 219,924

Note:
1. The household income range for M40 is RM4,850 – RM10,959
2. Estimates are based on interest rate of 4.25% and 35-year loan tenure.

Source: NAPIC (2020), DOS (2020), authors calculations

[5] Demographia (2020)
[6] Suraya Ismail et al. (2019)

In fact, our estimate shows the maximum price for an affordable home for the M40 under the housing cost burden and residual income is 50% more expensive than the maximum price under the median multiple measure. In other words, the median multiple approach derives a house price range that better reflects household incomes—whereas measures that includes financing distorts our view of what is actually affordable and pushes the 'affordable range' higher.

Cheap and easy access to financing can induce an artificial demand for housing, where there is an increase in demand as more people are able to purchase a house through a housing loan. However, if housing supply remains inelastic, this increased in demand can push house prices even further. This results in house buyers committing to more expensive housing[7] in addition to (mis)directing future supply of housing towards high-end houses.

Thus, an affordability indicator that includes financing better serves as 'snapshot' measures because they are influenced by factors or policies related to housing finance. For example, interest rates can vary over time, and the government can decide to increase or reduce the minimum downpayment amount. As pointed out in our earlier report, Making Housing Affordable[8];

> *"While measures to make credit more available and less costly may seem to make housing affordable, our position is that affordable housing means lowering the price of housing and not increasing the debt burden of households."*

What the median multiple is and what it is not

It is a measure for market affordability, NOT individual household affordability

Firstly, in understanding indicators for home buyers affordability, it is important to differentiate between market affordability and individual household affordability (see Figure 7). The median multiple is an indicator that assesses market affordability, rather than individual household affordability. For example, an abnormally high ratio signals that the housing supply system is restricted due to possible distortions or inflated housing demand, while an abnormally low ratio suggests house values being kept articially low (such as due to low-quality construction, insecurity of tenure, absence of housing finance, or a lack of consumer confidence in the economy)[9].

[7] KRI (2015)
[8] Ibid.
[9] Angel (2000)

Figure 7: Market affordability versus Individual household affordability

Market affordability
The general affordability of a given area as measured by the median home price in that area.

Individual household affordability
It is how much a household can afford on mortgage payments without facing a housing cost burden.

Source: Jewkes and Delgadillo (2010)

Local authorities can use market indicators such as the median multiple to assess which areas require more affordable housing developments, and plan accordingly. The industry uses market indicators to predict profitability of new housing developments in an area.

On the other hand, the median multiple is not an appropriate measure to assess individual household affordability, simply because each individual's circumstances is different. The individual household affordability depends on the ability of the household to afford on mortgage payments without facing a cost burden. As described by Jewkes and Delgadillo[10];

> *"For some people, all housing is affordable no matter how expensive it is. For others, no housing is affordable unless it is free."*

For example, a household with other commitments (e.g. car loan, credit cards payments, student loans) would have less residual income to spare, restricting their options to lesser priced homes.

The appropriateness of using the median depends on the distribution

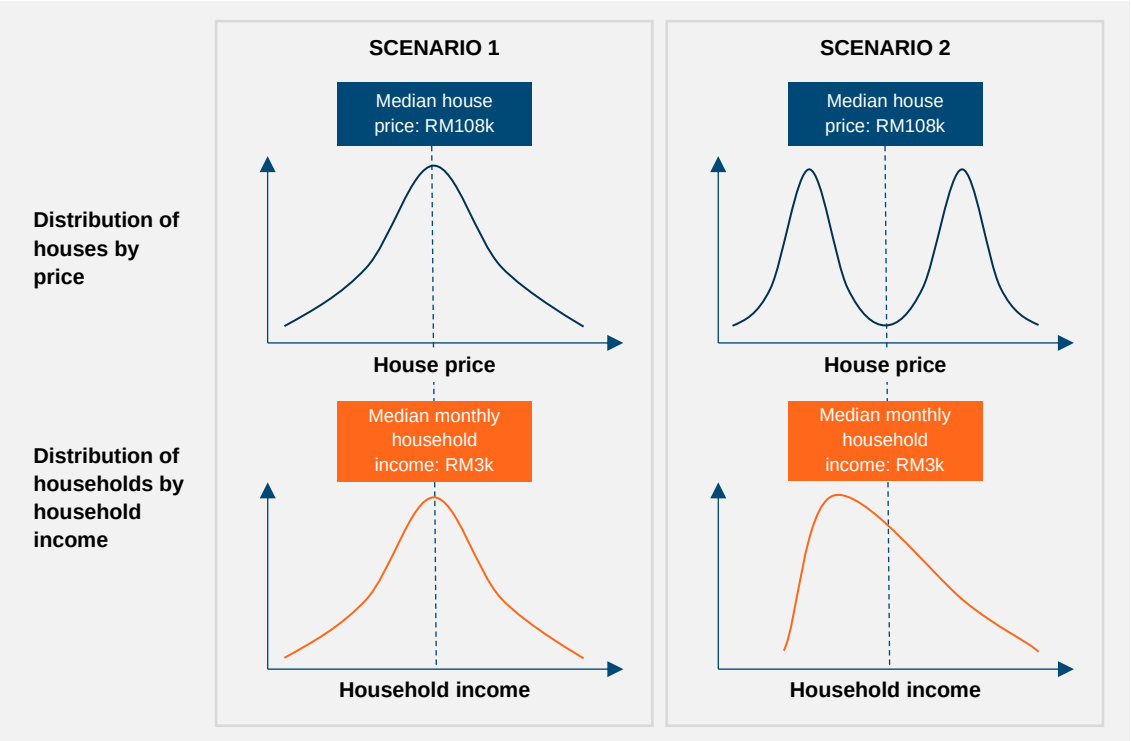
To recap, the median multiple measure uses the median value to describe house price and household incomes. The median is a measure of 'central tendency', which is the use of a single value to describe a set of data by identifying the central position within that set of data—also called summary statistics. Aside from the median, other measures of central tendency are the mean (average value) or mode (most frequently occurring value).

While the median multiple is a sensible measure to compare housing affordability between markets, it could not distinguish between two markets that have the same median value but different distributions of this value. For example, both city A and city B have a median house price of RM300k, but it could be that in terms of home sales, city A has a larger percentage of homes that are below RM200k, while city B has a larger percentage of homes above RM500k.

Figure 8 further illustrates how the median may not accurately reflect the distribution of house prices and household incomes when there is more than one 'peak' (values that occur frequently).

[10] Jewkes and Delgadillo (2010)

Figure 8: Median in a normal distribution versus bimodal and skewed distribution



Source: Authors' illustration

- In scenario 1, the median house price of RM108k is in line with the affordability threshold (3x annual household income of RM36k), and household distribution by income is a perfect reflection of house price distribution—a normal distribution. This scenario shows a responsive housing supply where households at all income level are able to afford a home within their means.
- In scenario 2, while the median house price is also 3x annual household income, the house price distribution is not responsive to household income. House price shows a bimodal distribution (two 'peaks') where supply is plenty of low-cost housing and luxury housing, but has very few mid-range homes. On the other hand, household income are positively skewed, which means more households are clustered at the left 'tail' of the distribution (more households are of lower income level). In this scenario, the options for middle-income households are limited to lower priced homes—and compete with lower-income households—or pushed to purchase higher priced homes beyond their means.

This limitation of using the median as a measure is acknowledged by Angel who noted that"…the distributional aspect of housing sector performance is of paramount importance, the absence of such measures does bias the results in favor of cities and countries with higher medians or means—of, say, house size—and against countries that may have lower medians or means but

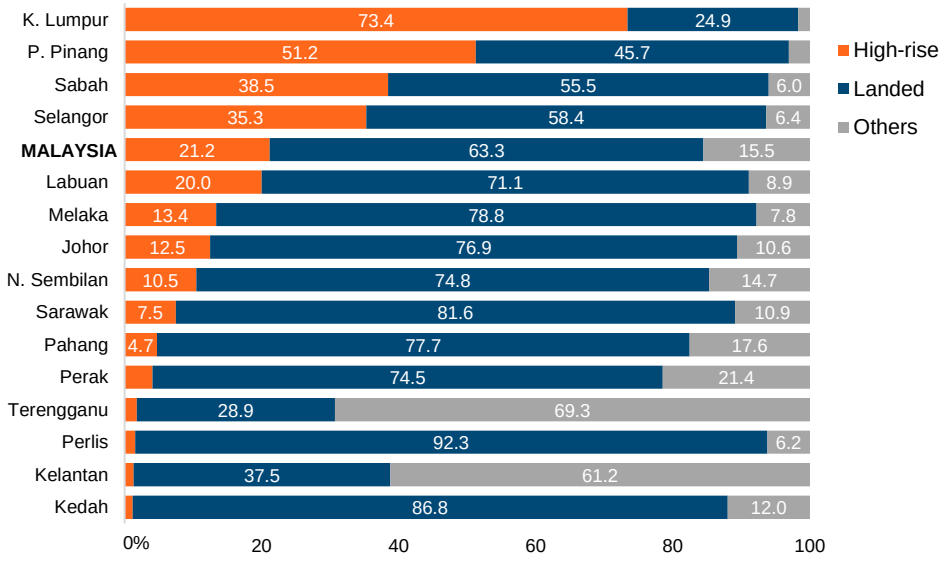
tighter and more equitable distributions"[11]. However data on such measures are more difficult to find[12].

It is a measure of affordability, NOT quality of housing

The median multiple is meant to measure affordability; it estimates a housing market's affordability using house price-income ratio. It is not meant to measure housing quality, as the indicator does not account for other factors that could enhance household's quality of life such as the characteristics of dwellings as well as individual preferences.

Figure 9 illustrates the composition of residential transactions by property type and state. It is observed that northern and eastern states like Kedah and Kelantan tend to purchase more landed properties. In contrast, western states with major economic centres like Kuala Lumpur, Pulau Pinang and Selangor tend to purchase more high-rise properties. The different purchasing pattern is a reflection of many factors, such as different population densities, household sizes, availability of land, and even lifestyle and cultural preferences.

Figure 9: Breakdown of residential transactions by property type, 2019



Note: High-rise properties include condominium/apartments, flats, low-cost flats, and town houses. Landed properties include detached and semi-detached homes, cluster houses, terraces and low-cost houses.
Source: NAPIC (2020), authors' calculations

Because of the difference between the housing market, RM300k may be able to afford you a large semi-detached house in one market, while the same amount can only afford you a small apartment in another.

[11] Shlomo Angel and Stephen Mayo initiated the Housing Indicators Program in 1990, which is a joint program of the World Bank and the United Nations, and subsequently embarked on the Global Survey of Housing Indicators. Source: Angel (2000)

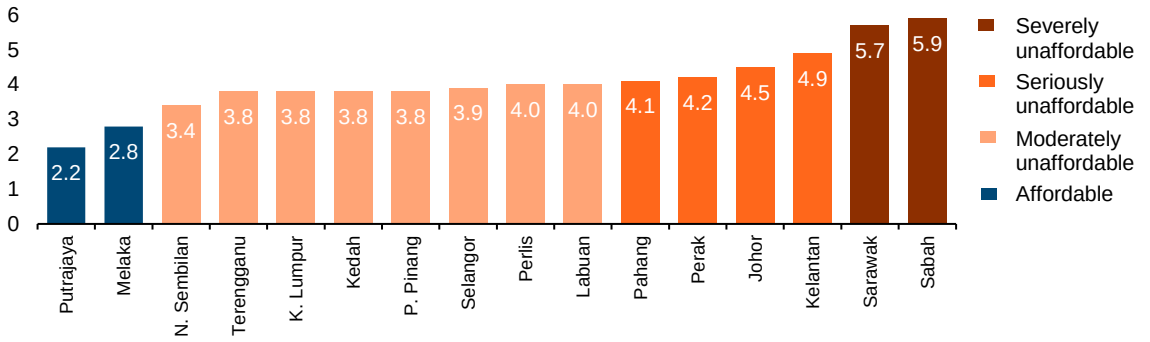
[12] For example, publicly available data on household income and house price in Malaysia are published in aggregates (or ranges) rather than micro data, which limits any distributional analysis.

The affordability of a housing market does not just affect a households' housing demand (what they want), but also their housing need (what they actually need). For example, a couple with a child can live comfortably in a one-bedroom apartment, which is within their financial affordability. As their family grows bigger, they would demand for a bigger unit, probably a three-bedroom house. In an affordable housing market, the couple may be able to afford their new housing requirement, fulfilling their housing demand and housing need. However, in an unaffordable housing market, the couple might find it difficult to fulfill their new housing requirement—hence, they continue to live in their house and exhibit an unmet housing need.

Therefore, when employing the median multiple indicator in planning and managing the housing supply, it is important to remember that it only covers one section of housing development which is affordability analysis. For a comprehensive housing analysis, assessments should also account for housing need to ensure that the future housing supply is not just affordable, but also of good quality.

Geographical or contextual factors that affect the interpretation of the median multiple

Figure 10: Median multiple by state, 2019



Source: NAPIC (n.d.), DOS (2020), authors' calculations

Figure 10 charts the median multiple across states. It suggests that all the states are unaffordable, with the exception of Melaka and Putrajaya. On the other hand, Sabah and Sarawak can be considered 'severely unaffordable'. However is that really the case? This brings us to the first contextual factor that needs to be considered when using the median multiple;

Consideration 1: Extent of informal housing out of the total housing market

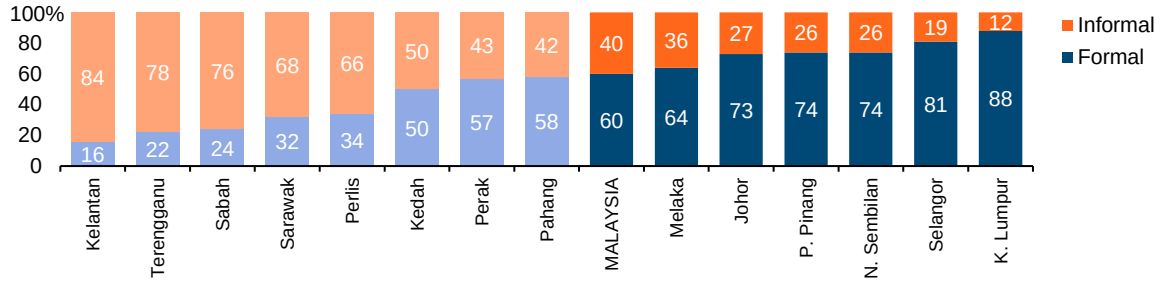
One of the issue that we uncovered in our earlier report, Making Housing Affordable is that the extent of the informal housing sector[13] varies between states. Figure 11 shows how more urbanised states such as Kuala Lumpur, Selangor, and Pulau Pinang's housing market are largely

[13] Informal housing stock are houses built without development orders and/or houses built by the community, and may include 'kampung' houses. There are instances when houses that have been built without development orders are sold and bought, and the transaction is captured by the local authorities. In such cases, these houses will enter into NAPIC's calculations for housing stock. Source: KRI (2015)

made up by the formal sector—while Kelantan, Terengganu, Sabah and Sarawak are largely made up by the informal sector. For Malaysia, 60% of the housing market is from the formal sector.

The house price sales data by the National Property Information Centre (NAPIC) only covers formal houses. Therefore, for states which have a large extent of informal housing, it is not accurate to use NAPIC's house price data to generalise housing affordability for the state.

Figure 11: Percentage of formal and informal housing by state, 2010



Note: The percentage of formal housing was estimated by comparing the number of housing units by NAPIC with the number of housing units by DOS (a sub-category of living quarters). The figures from DOS are based on the 2010 Census.
Source: KRI (2015)

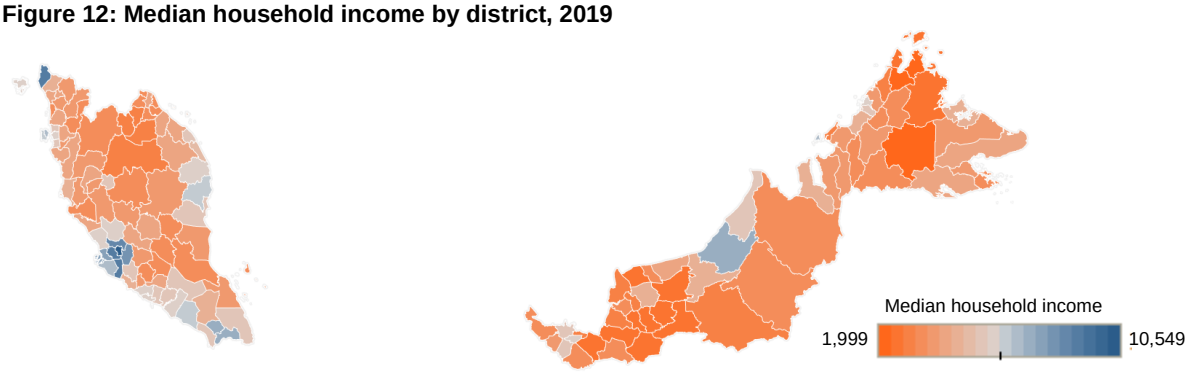
For KRI, in analysing affordability across states, we would only limit our analysis to states with a minimum of 60% formal housing. However, as states become more urbanised, more households will acquire houses from the formal sector.

Consideration 2: Analysis should be based on the local context.

Obviously any market affordability analysis would depend on the local context, due to how local conditions can vary between them. This was highlighted in KRI's earlier report, The State of Household 2018: Different Realities, in which highly urbanised and populated districts have higher median household income[14]. In 2019, the average household income in Greater Kuala Lumpur is 2 times the rest of Malaysia[15].

Figure 12 illustrates how household income vary between and even within states. For example, the median household income of Johor Bahru was RM7,342, while Mersing was RM3,896, showcasing the different incomes between the two districts in Johor.

Figure 12: Median household income by district, 2019



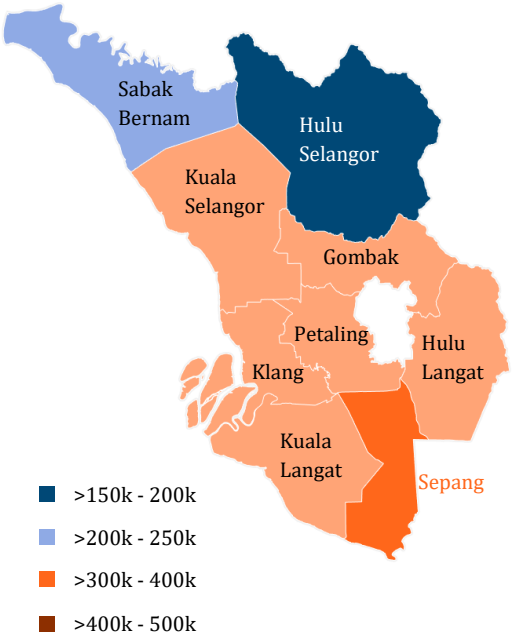
Source: DOS (2020)

[14] KRI (2018)
[15] Source: DOS (2020), KRI calculations

To illustrate how the affordability level would look like for different districts, we compare the median house price range[16] for Selangor with the affordable market price (desired affordable house price which is 3 times[17] the annual household income). When the median house price range is above the median market-3, the housing market is considered unaffordable and vice versa.

However due to the crudeness of the measure, if the affordable market price is within the median house price range, it may not necessarily be affordable due to the large price range. For example if the actual median house price in Gombak is above RM306k (affordable market price) and approaches RM400k, then the market is actually unaffordable.

Figure 13: Median house price range for Selangor, 2019



Source: NAPIC (2020), authors' calculations

Table 3: Estimating affordability level for Selangor, 2019

District	Median house price range[1]	Affordable market price-(median market-3)[2]	Affordability
Petaling	>300k - 400k	323,748	Seemingly affordable
Sepang	>400k - 500k	321,732	Unaffordable
Gombak	>300k - 400k	306,036	Seemingly affordable
Hulu Langat	>300k - 400k	300,996	Seemingly affordable
Klang	>300k - 400k	283,968	Unaffordable
Kuala Langat	>300k - 400k	250,200	Unaffordable
Hulu Selangor	>150k - 200k	224,964	Affordable
Kuala Selangor	>300k - 400k	210,780	Unaffordable
Sabak Bernam	>200k - 250k	160,344	Unaffordable

Note: 1. Range of transacted residential units in 2019. It excludes 'vacant plot' and 'others'.
Source: NAPIC (2020), DOS (2020), authors' calculations

The varying levels of housing affordability recorded between districts (Table 3) reflects the spatial heterogeneity between areas. Vast literature on housing affordability highlights the diverse economic and social benefits of certain locations—from cities to neighbourhood scale—to effect house prices[18]. For example, house prices tend to be higher in areas concentrated with employment centres, enabling households to easily access job opportunities or workplaces on a shorter commute.

[16] The median house price range refers to the price range at which the median transaction takes place. To derive the median house price range, the number of transactions were arranged according to NAPIC's house price ranges in an ascending order. To give an example, lets say district A recorded 1,000 transactions. Then, the median for 1,000 house sales is 500th sale, therefore, the price range which records the 500th transaction is selected as the median house price range. This estimate is used rather than the actual median price due to the unavailability of median price data lower than the state level.

[17] Following the median multiple threshold in which a ratio of 3 and below is considered affordable.

[18] Tan (2011), Usman Musa and Wan Zahari Wan Yusoff (2015), and Mohd Faris Dziauddin et al. (2015)

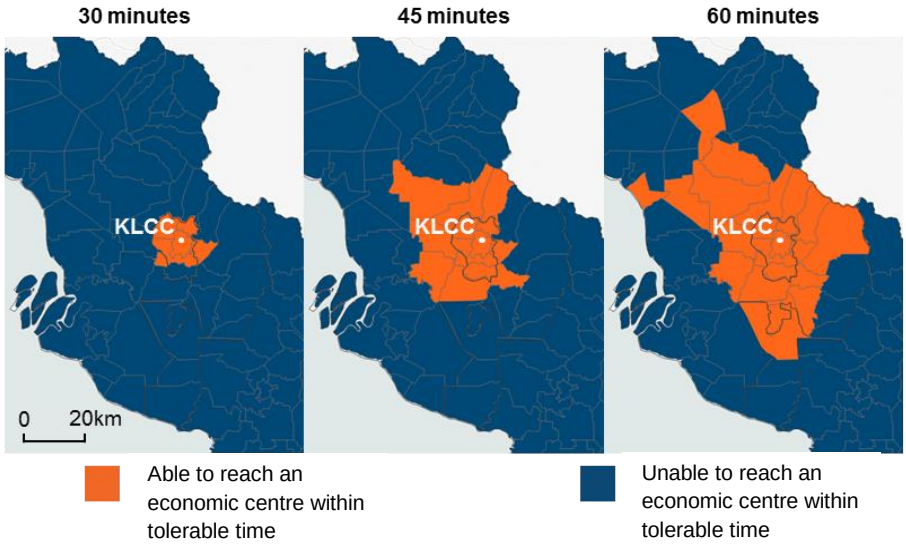
Similarly, closer proximity to healthcare, education and transport services as well as the availability of other desired amenities with purported benefit of raising households's quality of life such as shopping malls, convenience stores, and recreational facilities also contributes to higher house prices.

Functional conurbation as a better scope of measurement

The previous analysis uses state and district boundaries in assessing housing affordability, mainly due to household income and house price data being limited to that form. However, a more correct assessment of housing market affordability should be based on the functional boundary of conurbation areas, or functional conurbations, rather than administrative boundaries. A functional conurbation is when the boundaries of a conurbation is based on households' habitat—which includes homes, workplaces and public/social spaces[19]. Hence, a functional conurbation can cover beyond state boundaries, for instance due to the proliferation of urban sprawls and households' job-housing relationship[20].

Figure 14 illustrates the boundaries of the KL conurbation which hosts one of the country's major economic centres—Kuala Lumpur City Centre. By setting different tolerable commute time at 30 minutes, 45 minutes and 60 minutes, the figure shows the accessibliity of different mukims to KLCC. It can be seen that with an additional increase of 15 minutes travel time to KLCC, the boundaries of KL conurbation extends to the furthest mukims in Selangor and even to Putrajaya. For example, with 60 minutes, residents of Putrajaya can reach to KLCC, while with 75 minutes, even residents from Labu and Rasah from Negeri Sembilan can access KLCC.

Figure 14: Conurbation extent based on 30, 45 and 60 minutes tolerable commute time to Kuala Lumpur City Centre



Note: Commute times are based on travel by private car. This was calculated using Google Distance Matrix API, extracted Sep 2017.

Source: Suraya Ismail et al. (2019)

[19] This 'habitat' encompasses of an ecosystem of "first", second" and "third places" which are (1) Home and its environment – shelter, (2) Office and workplaces – places to earn income, and (3) Public/Social places – where community interation takes place. Source: Suraya Ismail et al. (2019), Oldenburg (1989)

[20] Suraya Ismail et al. (2019)

The advancement in transport technology has also contributed to the cultivation of urban sprawls. The presence of LRTs, MRTs, ETS, ERLs and other major and newer highways have enabled households to easily access their workplaces in major cities located in conurbation. In the case of KL conurbation, the major employment centres are located along the KL – Shah Alam and Klang area whereas the residentials areas are primarily found in KL – Petaling – Seremban area[21]. Thus, households can choose to stay in Seremban where house prices are lower than in KL yet can travel to KL to work for higher income.

The above examples shows how a housing market based on the functional conurbation is a better reflection of the housing ecosystem. Thus, the median multiple indicator can be improved by basing the calculations on this functional conurbation rather than limited to state and district boundaries . However, this requires more granular data to assess housing affordability and also warrants an inter-state coordination for housing development.

Concluding remarks

An 'indicator' should be treated as a sign or signal that shows something exists or is true or as a guidance to perform analysis with improved clarity. It is undeniable that median multiple affordability indicator is indeed a very useful tool in housing affordability analysis however, users need to be aware of its intended purpose and limitations, summarised as below:

1. Median multiple indicator assesses housing affordability based on house price and income variations, and does not include the role of financing.
2. It is a market affordability measure, neither an individual household affordability nor a measure of housing quality.
3. The appropriateness of using the median depends on the distribution. For instance, it is limited in assessing bimodal (or multimodal) distribution of house price and income.
4. Analysis using the median multiple depends on geographical or contextual factors such as the different local income levels and the extent of the informal housing market.
5. Analysis using the median multiple can be more accurate from looking at the perspective of functional conurbations rather than just limiting to administrative boundaries.

Therefore, in order to maximise the median multiple's potential, more granular data is necessary. We recommend the establishment of an integrated housing database—which captures both supply and demand factors of the housing market—to enable a more comprehensive analysis of the housing sector[22].

[21] For example, the Demographia International Housing Affordability report defines a housing market by the ability of residents to reach employment by daily commutes which is; a maximum 60 minute one-way commute time, while average work trip times tend to be about 30 minutes in most areas. Source: URI and FCPP (2021)

[22] See Puteri Marjan Megat Muzafar and Theebalakshmi Kunasekaran (2020) for more details on proposal to establish a national integrated housing database.

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