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# Economic analysis of house rent and demand for housing attributes in formal and informal built areas of Port Moresby

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# Background information

- In order to tackle housing problems, it is necessary to understand the supply and demand sides of housing delivery.
- Governments of most countries including Papua New Guinea (PNG) often focus more attention on the supply side such as construction of more houses (Miao, 2016).
- Little attention has often been given to demand side of housing such as characteristics (attributes) of houses being constructed in relation to consumers' preferences (Ahmad et al., 2013).
- The knowledge of demand for housing attributes is required to bridge the gap between the supply and demand sides of housing.

## Continuation

- Houses for rent is an important form of housing especially for low-income group. However, most Government of PNG's housing initiatives have focused on home ownership schemes (Ezebilo, 2017).

**Housing built areas can be classified as** (Arvanitis, 2013)**:**

- Informal built area
- No proper development plan
- Areas not serviced with trunk infrastructures
- No proper land titles.

- Formal built area
- Presence of proper development plan
- Areas serviced with trunk infrastructures
- Presence of proper land titles

# Continuation

- A house is a good with a bundle of attributes that vary in quantity and quality that combine to provide house rent (Rosen, 1974).

**Housing attributes can be classified into:**

- Structural attribute, i.e. physical condition of the house such as floor area, house type, number of rooms (Ligus & Peternek, 2016)

- Location attribute, i.e. accessibility to where the house is found such as distance to central business district (CBD), nearest bus stop, school and health centre (Gibbons et al., 2014).

- Neighbourhood attribute, i.e. characteristics of the area where the house is found such as infrastructure and services available in the area, type of dwelling area and dominant income group (Islam, 2012).

- Environmental attribute, i.e. environmental condition of the area e.g. availability of green and open spaces and playgrounds (Chen & Li, 2017).

# Objectives of the study

- To examine house rent for different suburbs of Port Moresby and influence of housing attributes on the rent value in formal and informal built areas of the city using the hedonic pricing method approach.

- To explore policy lessons on rental housing for the Government of PNG that can be drawn from the study.

# The Hedonic Pricing Method

- The hedonic pricing method (HPM) stipulates that a good is sold as a package that contains different attributes (Rosen, 1974).

- The HPM is based on the Lancaster theory of consumer demand (Lancaster, 1966) and framework by Rosen (1974) for estimating the value of a good that has several attributes.

* The theory posits that the satisfaction (utility) that a consumer gets from a good is associated with the individual attributes of the good rather than the good itself.

# Survey Design and Data Collection

- Data collected by means of mall/grocery store intercept face-to-face interviews using questions generated from group discussions, pre-test interviews and review of literature.

- Interviewees were selected using the multi-stage stratified random sampling technique:
  - First, Port Moresby was divided into 15 suburbs
  - Second, supermarkets, groceries and shopping malls were identified in each suburbs and 29 selected randomly.
  - Third, upon receipt of approvals from managers/owners of selected supermarkets etc., shoppers were selected randomly and interviews held with those that agreed to be interviewed.
  - Interviews were conducted during week days and weekends of June 2017.

- 30 survey assistants (mostly UPNG students) were trained for two days on survey techniques and administration.

- 1033 shoppers agreed to be interviewed.

# Continuation

- The questionnaire used for the interview survey had 57 questions. However, 22 questions relevant to this study was used. This include:

- Whether the interviewee lived in Port Moresby.
- Disposable income of the interviewee and that of the spouse from formal and informal employment.
- The suburb that the interviewee lived.
- Whether the interviewee lived in formal or informal built areas.
- The house type that the interviewee lived.
- The number of rooms that the interviewee and the family lived in.
- The number of bathrooms and toilets in the house that the interviewee lived.
- Whether toilet, bathroom are shared by different families.
- Weekly expenditure on house rent.
- Availability of water, electric power, sewerage, refuse removal services, public transport service, health care facility, school, recreation area and car parking space.
- The distance of suburb where the interviewee lived from CBD was obtained using Goolgle map.

# Econometric Model

- After several statistical tests and corrections such as:

- Test for homoscedasticity (equal variance).
- Transformation of some variables to log form to correct for heteroscedasticity.
- Use of White's heteroscedastic consistent variance estimator to further correct for heteroscedasticity.

This resulted into the following hedonic pricing model:

$$\text{Log(H\_RENT)} = B_0 + B_1\text{Log(DIST)} + B_2\text{SCHOOL} + B_3\text{HEALTH} + B_4\text{Log(ROOM)} + B_5\text{BATO} + B_6\text{HOUSE\_T} + B_7\text{Log(BATH)} + B_8\text{Log(TOILET)} + B_9\text{REC} + B_{10}\text{DWELL} + B_{11}\text{INFRA} + E$$

The above model was estimated using log-log Least Squares regression.

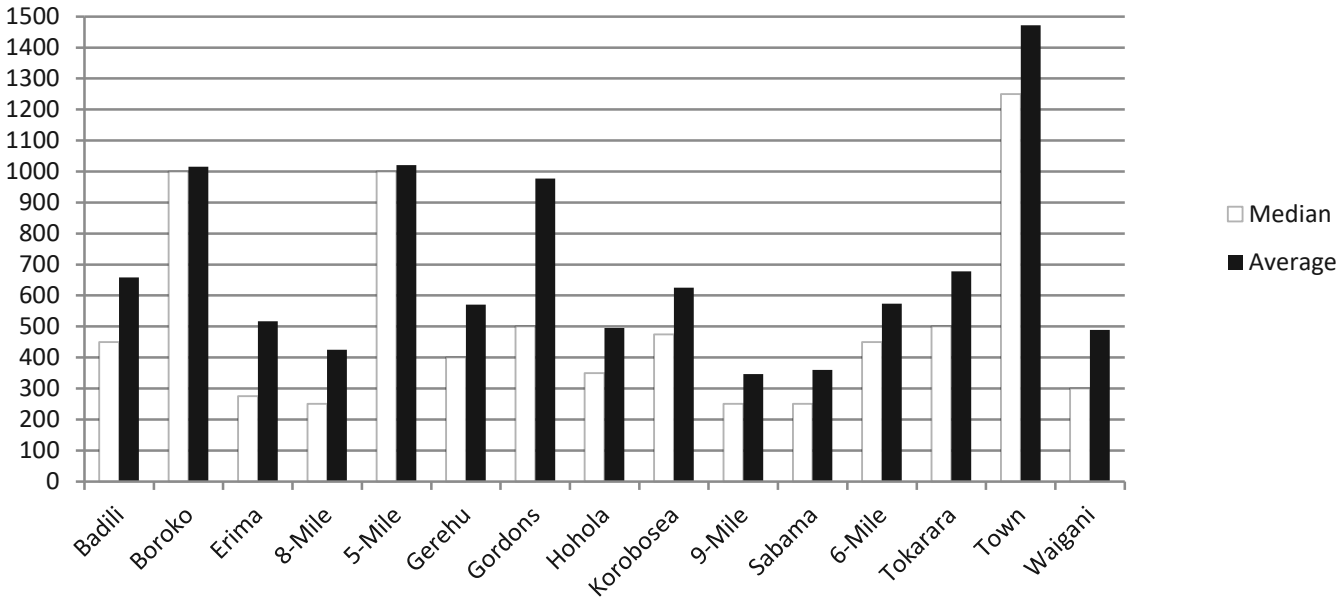
# Results

- Of the 1,033 shoppers interviewed, 39% (405) lived in a rented house.
- 98% (398) of the 405 interviewees answered all questions relevant for this study. Thus, the analysis is based on 398 observations.
- 55% of the interviewees lived in formal built areas and 45% in informal areas.
- Average monthly house rent for all interviewees: K2,662
  Formal built areas: K3,147
  Informal built areas: K2,246

*1US$ = K3.2 during period of study

# Continuation

**Fig1** Median and average weekly house rent in Kina



## Continuation

- Median annual income for all interviewees: K19,526
- Median annual house rent for all interviewees: K23,040

Housing affordability index: 23,040/19,526 = 1.2

This means that house rent for 50% of the interviewees is greater than their income by 20%.

- Town suburb had the highest index (2.94)
  Boroko had 2.22
  8-Mile had the lowest index (0.51).

**Fig 2** Average monthly house rent (Kina) in relation to housing attributes

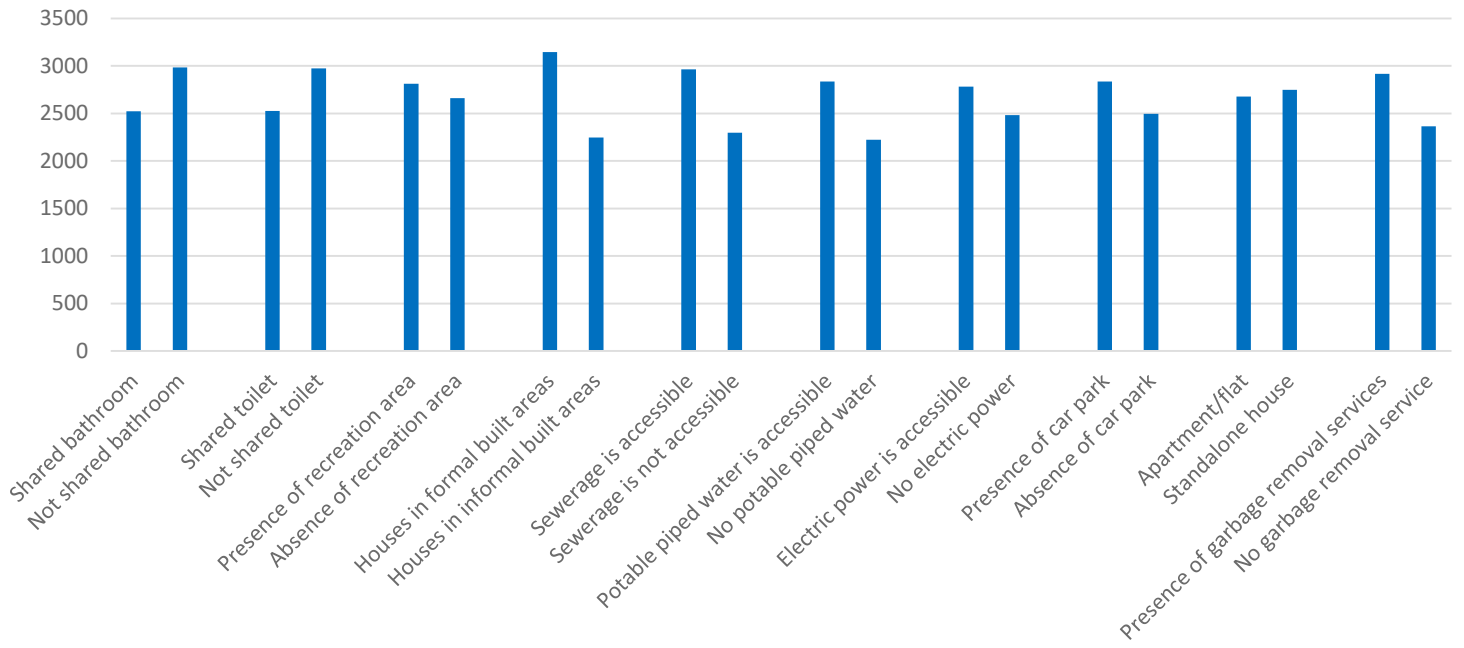


**Table 1** Socio-economic characteristics of interviewees

| VARIABLE | DESCRIPTION | MEAN | SD |
|---|---|---|---|
| Income | Household's disposable in in Kina per year | 38,971 | 55,429 |
| H/size | No. of persons in the interviewee's household | 8.60 | 5.34 |
| Gender | Interviewee's gender: Female = 1, 0 = Male | 0.40 | 0.45 |
| Age | The interviewee's age in years | 36.08 | 11.13 |
| Edu | The interviewee has university education: Yes = 1 No = 0 | 0.22 | 0.41 |
| Marital status | The interviewee is married: Yes = 1 No = 0 | 0.29. | 0.45 |

**Table 2** Description of variables used in statistical analysis

| Variable | Description | Mean | SD |
|---|---|---|---|
| | DEPENDENT VARIABLE | | |
| H_RENT | Interviewee's monthly expenditure on house rent in Kina (K) = House rent per week x 4 weeks. | 2,662<br>[3,147]<br>(2,246) | 2,832<br>[3,244]<br>(2,581) |
| | LOCATION ATTRIBUTES | | |
| DIST | Distance in km of suburb where the interviewee lived from the CBD. | 10.63<br>[11.35]<br>(11.03) | 5.11<br>[4.94]<br>(4.63) |
| SCHOOL | Distance of interviewee's dwelling to the nearest elementary school in metre. | 649.39<br>[511.44]<br>(755.43) | 748.23<br>[663.07]<br>(786.69) |
| HEALTH | Distance of interviewee's dwelling to the nearest health care facility in metre. | 790.54<br>[749.22]<br>(953.33) | 777.60<br>[759.83]<br>(811.69) |

**Continuation of Table 2**

| | | | |
|---|---|---|---|
| **STRUCTURAL ATTRIBUTES** | | | |
| ROOM | The number of rooms that the interviewee's household lived in. | 2.62<br>[2.86]<br>(2.62) | 1.16<br>[1.12]<br>(1.19) |
| BATO | The same toilet and bathroom are used by different families where the interviewee lived: Yes = 1 (%)<br>No = 0 | 56.03<br>[44.65]<br>(57.33) | 0.49<br>[0.49]<br>(0.49) |
| HOUSE_T | The type of house that the interviewee dwells in:<br>Apartment/flat = 1 (%)<br>Standalone house =0 | 25.38<br>[26.06]<br>(14.09) | 0.44<br>[0.44]<br>(0.35) |
| BATH | Number of bathrooms in the house where the interviewee lived | 1.25<br>[1.27]<br>(1.14) | 0.57<br>[0.59]<br>(0.43) |
| TOILET | Number of toilets in the house where the interviewee lived | 1.30<br>[1.31]<br>(1.21) | 0.73<br>[0.68]<br>(0.43) |

**Continuation of Table 2**

| | | | | |
|---|---|---|---|---|
| | ENVIRONMENTAL ATTRIBUTE | | | |
| REC | The interviewee lives near a recreation area: | Yes = 1 (%) | 49.04 | 0.50 |
| | | No = 0 | [57.19] | [0.50] |
| | | | (46.67) | (0.49) |
| | NEIGHBOURHOOD ATTRIBUTES | | | |
| DWELL | Interviewee lives in informal built areas: | | | |
| | | Yes = 1 (%) | 45.22 | 0.49 |
| | | No = 0 | | |
| INFRA | The house where the interviewee lived had potable piped borne water, sewerage and electric power: | Yes = 1 (%) | 63.07 | 0.48 |
| | | No = 0 | [77.57] | [0.42] |
| | | | (25.15) | (0.43) |

*1US$ = K3.2; formal area is in square bracket; informal area is in parenthesis.*

**Table 3** Factors influencing demand for housing attributes

| | FORMAL+INFORMAL | | FORMAL | | INFORMAL | |
|---|---|---|---|---|---|---|
| ***Variable*** | ***Coeff.*** | ***t-value*** | ***Coeff.*** | ***t-value*** | ***Coeff.*** | ***t-value*** |
| Constant | 8.36 | 42.44**** [0.19] | 8.09 | 32.71**** [0.25] | 8.30 | 30.75**** [0.27] |
| LOCATION ATTRIBUTES | | | | | | |
| Log(DIST) | -0.47 | -9.39**** [0.05] | -0.40 | -6.93**** [0.06] | -0.58 | -7.42**** [0.08] |
| SCHOOL | -0.0002 | -2.34** [0.007] | -0.0001 | -1.25 [0.009] | -0.0002 | -1.88* [0.009] |
| HEALTH | 0.0001 | 1.73* [0.0006] | 0.0001 | 1.26 [0.0008] | 0.0001 | 1.41 [0.0009] |
| STRUCTURAL ATTRIBUTES | | | | | | |
| Log(ROOM) | 0.35 | 3.79**** [0.09] | 0.40 | 3.38**** [0.12] | 0.27 | 1.98** [0.14] |
| BATO | -0.18 | -2.05** [0.09] | -0.21 | -1.97** [0.11] | -0.12 | -0.84 [0.15] |

## Continuation of Table 3

| | | | | | | |
|---|---|---|---|---|---|---|
| HOUSE_T | 0.06 | 0.59 [0.09] | 0.05 | 0.47 [0.12] | 0.03 | 0.17 [0.18] |
| Log(BATH) | 0.15 | 0.88 [0.17] | 0.22 | 0.93 [0.24] | 0.05 | 0.19 [0.25] |
| Log(TOILET) | -0.16 | -1.20 [0.14] | -0.19 | -0.94 [0.21] | -0.12 | -0.67 [0.18] |
| ENVIRONMENTAL ATTRIBUTE | | | | | | |
| REC | 0.11 | 1.26 [0.09] | 0.26 | 2.26** [0.12] | 0.08 | 0.58 [0.14] |
| NEIGHBOURHOOD ATTRIBUTES | | | | | | |
| DWELL | -0.28 | -2.92*** [0.09] | | | | |
| INFRA | 0.09 | 0.91 [0.10] | 0.25 | 1.67* [0.15] | -0.02 | -0.13 [0.14] |

****, ***. **, and * are 0.1%, 1%, 5% and 10% statistical significant levels; standard error is in square bracket

## Continuation of Table 3

| | | | |
|---|---|---|---|
| $R^2$ | 0.25 | 0.21 | 0.26 |
| Adjusted $R^2$ | 0.23 | 0.17 | 0.22 |
| F-value | 11.94**** | 5.67**** | 6.08**** |
| Br. / Pagan LM Chi-squared | 12.16 | 3.60 | 9.15 |
| p-value | 0.35 | 0.96 | 0.52 |
| No. of observations | 398 | 218 | 180 |

# What can we learn from the results?

- An increase in distance of dwelling from CBD is associated with a decrease in house rent in formal and informal built areas.
- An increase in distance of home from elementary/primary school is associated with a decrease in house rent in informal built areas.
- An increase in number of rooms is associated with an increase in house rent in formal and informal built areas.
- The use of the same bathroom and toilet by different families is associated with a decrease in house rent in formal built areas.

- The availability of a recreation area is associated with an increase in house rent in formal built areas.
- Availability of basic infrastructure is associated with an increase in house rent formal built areas.
- The presence of informal built areas is associated with a decrease in house rent.

## The most important determinants of house rent

The use of:

- The same bathroom and toilet by different families,
- access to recreation area and
- access to basic infrastructure

are the most important determinants of house rent in **formal built areas.**

Distance of dwelling to CBD is the most important determinant of house rent in **informal built areas.**

## Potential Lessons for the PNG Government

- House rent in Port Moresby is beyond the reach of most residents. The National Housing Corporation (NHC) should consider developing affordable house rent scheme in collaboration with large scale private developers.
- Informal built areas of Port Moresby play an important role in provision of housing for low-income group, which contribute to affordable housing.
- There is a high demand for basic infrastructure in houses located in formal areas. It is necessary for NHC and municipal authorities such as NCDC to ensure that infrastructure are provided before property developers construct houses in Port Moresby.
- There is a high demand for recreation area in formal built areas. There is a need for NCDC to implement the Open Space Policy.
- There is a high demand for homes close to CBD. Multi-family high-rise apartment/flat blocks is required to maximise use of land.

# Conclusions

- Most households who reside in Port Moresby tend to have housing affordability problems.
- Provision of affordable house rent scheme has the potential of reducing housing affordability problems in the city.
- The demand for housing attributes is strongly linked to type of dwelling area, infrastructure, recreation area, bathroom and toilet arrangements, distance of home from health care facility, school and CBD.
- Affordable house rent scheme will be successful if preferences and demand of potential tenants are considered in the construction of the houses.

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# THANK YOU

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