PN-AAU-605

AN ANALYSIS OF LOW-INCOME DEMAND FOR SHELTER: THE CASE OF LUSAKA, ZAMBIA

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January 1981

project # 931-1090

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INTRODUCTION

This paper attempts to look at low-income housing demand in three Lusaka neighborhoods. We use cross-section data from a home improvement survey carried out during June - September 1979 among low-income households in three neighborhoods in Lusaka.

Our objective is to estimate the response of the demand for housing from changes in income for owner-occupant households. We therefore try to estimate the income elasticity of demand for housing services. We also want to know the value of a dwelling, especially its attributes, to low-income households. In this respect we undertake to estimate the marginal value of the attributes of a dwelling. In both cases, we use regression analysis to derive an estimate of income elasticity and a hedonic price index for housing quality.

At the outset, we look at the main factors that interact to determine the demand for housing. We briefly explore the growth rate of national income, population and the rate of urbanization in Zambia. Then, finally, we examine the results of our empirical evidence.

I. ECONOMIC BACKGROUND:

The economy of Zambia is heavily dependent on copper production. Both the level of output and the rate of growth of the economy is determined by the performance of the copper industry. For example, in 1978 copper production contributed about eleven percent of the gross domestic product and 91 percent of the total export earnings. In terms of employment, the copper industry has for a long time been the largest employer. In 1974, 28 percent of the total formal employment in the private sector was in the mining sector.

However, since 1970, the economy has been adversely affected by the low-copper prices on the world market. This adverse effect has been most dramatic

on the availability of foreign exchange and government revenue. For example, in 1970 mineral revenue as a percentage of total government revenue was forty percent. This dropped to nearly nothing in 1978.

On the whole the Zambian economy can better be described as stagna ting. Between 1960 and 1978, total output grew at an average rate of 9 percent per annum in nominal terms. The economy hit a gross domestic product of 2,900 million dollars at current prices in 1978. However, in real times the economy was static, growing at an average rate of 0.02 per annuam. The real per capita gross domestic product in 1978 was 265 dollars.

Meanwhile, in 1979, the total population for the country was estimated at six million. Between 1963 and 1978 it grew by about 50 percent with an average annual growth rate of three percent per annuam. Table 1 shows the figures for the total population and output for selected years between 1963 and 1978.

Sixty percent of the total population lives in rural areas and the other forty percent lives in urban areas. The urban population has been growing very rapidly. Zambia has always experienced a higher rate of urbanization than most other countries in tropical Africa. This was the consequence of the early development of the mining industry during the colonial period. However, there has been an unprecedented rural-urban movement of people during the period immediately following the attainment of independence in 1964. Families migrate to join their working relatives in urban areas and to seek employment in the new import-substitution industries which were being established. This process was enhanced by the removal of legal restrictions of movement between urban and rural areas by the new post-colonial government.

During the period 1963-1969, urban population grew by about 67 percent. The average annual growth rate was 9 percent. It has been estimated that 90

TABLE 1

ESTIMATED POPULATION AND GROSS DOMESTIC PRODUCT 1963-78, SELECTED YEARS.

Year	1963	1969	1972	1975	1978	Mean Annual Growth Rate %
Population '000	3,597	4,123	4,527	4,981	5,472	3.2
GROSS DOMESTIC PRODUCT AT 1970 PRICES ($' Million)	144 8	144 7	1,446.	1,446	1,450	0.02
GROSS DOMESTIC PRODUCT AT CURRENT PRICES ($' Million)	531	156 7	1,693	1,98 9	2,900	9
PER CAPITA G-D P AT 1970 PRICES $	403	35I	31 9	290	265	-

SOURCE: Republic of Zambia, Third National Development Plan 1979-83, National Commission For Development Planning. (Lusaka, October 1979). pp. 320.

Republic of Zambia. 1974 Sample Census of Population. Second Report. (Lusaka, Central Statistical Office. January, 1979).

percent of the additional population growth in the country during this period took place in the urban areas.[1] Between 1969 and 1974, total urban population grew by 38 percent. The average annual growth rate declined to 7 percent. During the period between 1974 and 1978, the rate of growth of the urban population declined further growing by 30 percent. The mean annual growth rate seems to have stabilized at about 6 percent.

Table 2 shows the estimated population for urban and rural areas between 1963 and 1979. We also show projected figures up to 1984. By that year, the total urban population is expected to be about 45 percent of the total population.

ESTABLISHMENT OF CITIES AND TOWNS

Towns and cities in Zambia developed during the colonial period with colonial settlement. The way these towns were established and the legal and institutional rules surrounding their establishment has had and continues to have an effect on the nature of the housing problem in the urban areas.

The first towns were established by the British South African Company at the beginning of this century. It had legal jurisdiction over most of the present Zambia from the British government. The major urban centers were concentrated along the main line of rail which runs through the middle of the country from the south to the coppermines, in the north. The towns grew rapidly as the company tried to fulfill its obligation to provide housing for the workers on the railroad, the new mines being opened, and the administrative staff of the company.

The discovery and the exploitation of copper during the twenties on the copperbelt and the subsequent growth of the economy resulted in the rapid growth of size and number of these "copper" towns.

ESTIMATED RURAL-URBAN POPULATION DISTRIBUTION. 1963-84 SELECTED YEARS

Year	Population (Thousands)			Ratio of Urban to total Population %
	Total	Urban	Rural	
1963	3,489	715	2,774	20.5
1969	4,056	1,192	2,864	29.4
1971	4,386	1,401	2,984	31.9
1972	4,527	1,497	3,030	33.1
1974	4,695	1,656	3,039	35.3
1976	5,138	1,916	3,222	37.3
1977	5,302	2,033	3,269	38.3
1978	5,472	2,153	3,319	39.4
1979	5,649	2,280	3,369	40.4
1980	5,834	2,413	3,421	41.4
1982.	6,228	2,696	3,532	43.3
1984	6,657	3,007	3,650	45.2

Source: Republic of Zambia, Third National Development Plan 1979-83, National Commission For Development Planning. (Lusaka, October 1979). p. 320.

Republic of Zambia. 1974 Sample Census of Population. Second Report (Lusaka, Central Statistical Office. January, 1979)

The stock of urban housing was built, financed and subsidized by the mining companies on the copperbelt and by the colonial government in other urban areas, with copper revenues from the mining companies. The housing stock, especially for the high income group, was usually of a very high standard and unrelated to the ability to pay of the occupants. Consequently, it was heavily subsidized.

As the mining industry developed and the economy grew in the fifties, other industries developed. There was an increased demand for labor as new employment opportunities were created in the urban areas. Colonial policy then attempted to stabilize the African laborforce in the urban areas. Together with this came the policy to provide low-income housing to employed urban workers. It was made an obligation for urban local authorities and large employers in any industry to provide housing for urban workers.

Local authorities built housing areas for low-income workers at the periphery of towns. Employers were allowed to rent the dwellings for their workers.

Most of these low-income dwellings were also built to very high standards and adhered to strict building and health codes. The rentals were unrelated to cost or the occupants' ability to pay. Furthermore, the rights to live in these low-income housing areas were conditional on being in continuous formal employment. You lost the dwelling when you either changed employment or got fired.

This legal and institutional framework of the colonial period inhibited the growth of a private market for housing. Most urban workers, in one way or another, had their housing provided by their employers. By the time of independence in 1964, urban areas in Zambia had three main types of housing stock:

(a) There is the high income housing stock, which is segregated and of a very high standard. It is provided with services. It is heavily

subsidized. Most of it is rented. It was estimated in 1964 that 90 percent of the urban population lived in housing provided for or paid for by the employer.(2)

(b) Low-cost housing stock built mostly at the periphery of the town by the local councils. It is usually of lower standard, heavily subsidized and rented.

(c) The informal housing stock. This is built by low income households on private or public land. It is of low standards with few basic services if any. It is usually built by the owners. It is either owner-occupied or rented.

Table three shows the distribution of total housing stock in urban areas in 1974 and 1978. It can be seen that between these four years the contribution of the formal housing stock has declined, while that of the informal housing stock has increased. In 1974, the informal stock contributed about 36 percent to the total housing stock this increased to nearly 50 percent in 1978.

The growth process and the rapid rate of urbanization has increased the demand for housing tremendously. The institutional and legal setting has contributed to a severe deficit of housing stock and housing related services by making the supply of housing very inelastic. At the time of independence in 1964, the post-colonial government did not have a clear policy for informal low-income housing areas, which was already by then a major source of low-income housing stock in urban areas. There were attempts to eradicate them when it was politically possible. They were ignored when it was not. However, the government now accepts the importance of informal housing units and as such it has strived to change its policy with the Second National Development Plan 1972-1976. Low-income housing, especially informal housing, is now seen as one

TABLE 3

URBAN SHELTER: DISTRIBUTION OF URBAN HOUSING STOCK. 1974, 1978.

	PERCENTAGE SHARE OF TOTAL STOCK	
YEAR	1974	1978
Formal Stock	63.70	52.6
High - Medium Cost	11.2	9.87
Servants Quarters	5.1	4.78
Low Cost	47.4	42.72
Informal Stock	36.2	47.4
Serviced Site	7.1	9.90
Improved Units	-	6.30
Squatter Units	29.1	31.20
Total	100	100

Source: Republic of Zambia. Third National Development Plan 1979-83. National Commission For Development Planning. (Lusaka, October 1979) p. 32.

of the major potential sources of the total housing stock. Their upgrading is now integrated as part of the national development plans.

Low-income housing can be a major source of the dynamic needed to spur growth in low-income countries, provided an institutional and legal framework is created which is conducive to such growth. This is one major aspect of the growth process that has been neglected by most low-income countries. However, an institutional framework has to be worked out which creates incentives for low-income households to participate in this process. The general direction seems to be the creation of a framework which encourages individual home ownership and the development of a rental market in the low-income housing areas. The state can also help in this process by providing basic public services and carrying out policies conducive to the upgrading of dwellings by the low-income households.

An urban policy focusing on low-income housing, linked to the building materials and construction sectors, as part of the overall growth policy can not only contribute to economic growth, but also to employment generation, equity and participation in the growth process.

However, what we do not know much about is the demand for low-income housing at different levels of income and prices from that of the high income countries. To analyze the potential contribution of low-income housing to growth, employment, equity and participation, we need empirical studies on income and price elasticities and housing quality. Our study strives to understand the housing market in the low-income housing areas in Lusaka.

TABLE 4

ESTIMATED TOTAL AND SQUATTER POPULATION OF LUSAKA. SELECTED YEARS

YEAR	POPULATION THOUSANDS TOTAL	SQUATTER	SQUATTER POPULATION AS % OF CITY POPULATION
1954	48	12	25
1957/8	65	12	19
1963	110	11	13
1969	264	92	35
1972	351	-	-
1973	375	135	36
1976	483	-	-
1977	520	-	-
1978	559	-	-

Source: Seymour T. Squatter Settlement and Class Relations In Zambia.* (Lusaka, University of Zambia n.d.)

TABLE 5

DISTRIBUTION OF LUSAKA HOUSING STOCK 1974

CATEGORY	NUMBER OF UNITS	PERCENTAGE SHARE OF TOTAL STOCK
High-Medium Cost	9,165	12.4
Low-cost	16,756	22.64
Servants' Quarters	6,302	8.52
Serviced Sites	7,908	10.7
Squatter Units	33,869	45.8
Total Stock	74,000	100

Source: Jayarajan C.K. Shelter Situation in Zambia. (Lusaka, Department of Country and Town Planning, 1976)

LUSAKA, ZAMBIA

Lusaka is the largest urban center in Zambia. It developed within the site of an African village and became initially a mere railroad siding on the railroad to the copperbelt in 1905.[3] It soon developed into a commercial and agricultural marketing center with an active local farming community. However, its growth was slow until in 1935 when it became the new capital and administrative center of the country. By 1963 it had a total population of 110,000. This increased to about 500,000 eleven years later, in 1974. The annual growth rate of the city population now seems to have stabilized at about seven percent.

Table 4 shows the total population of Lusaka and the estimated squatter population for selected years between 1954 and 1978. Table 5 gives us the distribution of the total housing stock for Lusaka in 1974.

The three low-income housing areas studied are Kaunda Square, Chawama and Bauleni. Kaunda Square is situated in the eastern part of Lusaka. In 1975 it had an estimated population of 6,245. It is one of the oldest sites and service schemes in the country.

Chawama is located in the southern part of the city. It has an estimated population of 38,000. Bauleni is in the south-eastern part of Lusaka. It has an estimated population of 3,000 (1973).

II. ESTIMATES OF INCOME ELASTICITY OF DEMAND

For our analysis of the estimates of the income elasticities of demand we use three functional forms--the linear, semi-logarithmic and the logarithmic.[4] The logarithmic form gives us a better fit. We discuss the other functional forms in the appendix.

Apart from estimating income elasticities for the whole sample of owner-occupant households, we also segment our sample into three submarkets for housing. This will enable us to get the area-specific coefficients.[5] We do this for Bauleni, Kaunda Square and Chawama.

Our functional form for the constant elasticity model is:

$$\text{Ln } P = a_0 + a_I \ln A + a_2 \ln Y + a_3 D_I + a_4 D_2$$

Where = P = Value of the House

A = The Number of Equivalent Adults per Household

Y = Monthly Household Income

D_1 = 1 Household Head Younger Than 30 Years, 0 Otherwise

D_2 = I Household Head Between 30 and 50 Years, 0 Otherwise

The value of the house is the asking price that the house can be sold for in the market. The respondents were asked at what price they could sell their houses under the current market conditions. Most respondents valued their houses at a much higher price than it had cost them to build or buy the house. The main reason given was that they had improved on the house, adding a kitchen, or room or just mere plaster and paint. However, it is also likely that the value of the house had increased because of the shortage of dwelling units.

Monthly family income is an estimate of the current total disposable income available to the household from various sources. Most households reported wage income as the most important component of family disposable income. For those households who work in the public sector, their wage income is likely to be stable over a long period. Public sector employment is more or less permanent because of employment regulations.

This implies that current disposable income is likely to be used as a basis of decisions with a long term horizon such as housing.

It is theoretically accepted that permanent income is one of the major determinants of the demand for housing.(6) This is based on the assumption that households look beyond their current planning period's income in making their demand choices. With perfect capital markets households can borrow against their future incomes and spread out their consumption of housing services over their horizons in a way consistent with their permanent incomes. In this situation, transitory income is clearly a less important factor in the consumption decision.

Transitory income can be a factor in making improvements to the house. A sudden windfall from a relative can contribute to the marginal decision to improve the house. For elderly households such windfalls, for example, dowry,

are likely to be substantial.

Recently Goodman and Kawai have argued that both transitory and permanent income components should be included as separate independent variables.(7) They argue that such a separation of measured income in the regression equation, into transitory and permanent components, should substantially improve the estimation power of the housing demand equation.

However, in our study we use monthly measured income, rather than permanent income in the regression equation.

Empirical studies that employ some concept of permanent income in their estimation of income elasticity of demand for housing, report a higher elasticity than studies using measured income. This is because of the fixity and the high transaction costs of housing demand choices in the short run. We consequently expect our estimation of income elasticities to be biased downward.(8)

The demographic variables included in the regression equation are the household size and the stage in the life cycle of the head of the household. The demographic variables were included because they affect housing choices. One can argue that the demographic element in housing demand is influenced by income. For example, one would expect the formation and dissolution of households to be determined largely by income.

More specifically one respondent built a new dwelling to accomodate his second wife. It can be said that income is likely to have underpinned this decision.

We therefore expect omission of the demographic variables to affect our estimate of the income elasticity of demand.(9)

We use the number of equivalent adults per household as a measure of the size of the household. The number of equivalent adults per household was found by giving one point to any member of the household who is older than

fourteen years. Any member of the household younger than fourteen years was given half a point.(10)

The hypothesis here is that the number of equivalent adults per household is certain to have more influence on housing demand than the size of the household or the ratio of members of the household over fourteen to those under fourteen. This is a hypothesis which needs to be tested.

If the level of spending differs for dissimilar age groups because tastes differ, then we are likely to get a better estimate of income elasticy if we divide life cycle categories.

We divide households into three states--those whose head is less than thirty years old, between thirty and fifty, and greater than fifty years old.

OWNER-OCCUPANT INCOME ELASTICITIES

The total sample of owner occupants consists of 157 households in the three geographical housing submarkets--Chawama, Kaunda Square and Bauleni. Table 6 shows the characteristics of the households in the sample.

Twenty five percent of the households live in Bauleni, twenty four percent in Kaunda Square and fifty one percent in Chawama.

Most households had a monthly income of about 163 dollars, and lived in a dwelling worth nearly 3,000 dollars.

The majority of the household heads were middle aged. Sixty eight percent of the household heads were between 30 and 50 years old. Only 13 percent of the household heads were younger than 30 years. Nineteen percent were older than 50 years.

The household size was about five equivalent adults. Let us say, composed of three adults and four children, if we could speculate.

We therefore get a picture of our owner-occupant household. Of course,

the head of the household owns the house worth about 3,000 dollars. He is aged between 30 and 50 years--most probably he is 40 years old. The household has a total monthly income of 163 dollars.

The household consists of seven people. Three adults, one child over fourteen years old or a relative and four children.

What is the estimated income elasticity of demand for such a household? Table 7 shows us the estimated coefficients of equation 1. From the regression of the equation we get an estimated income elasticity of 0.8 with a standard error of 0.13. This means that if income increases by 10 percent, demand for housing will increase by 8 percent. Furthermore our coefficient is significantly different from zero at the 95 percent confidence level.

This result is not different from that found elsewhere (11) --i.e. that the income elasticity is at most unity. Furthermore, our estimate indicates the potential which exists for home improvement of houses by owner occupants and housing related investments.

The demographic coefficient for equivalent household size is 0.7, with a standard error of 0.2. It is significantly different from zero at the 95 per cent level of confidence.

The estimated coefficient means that larger households demand more services than smaller households. It also implies that , for any particular equivalent household size, the one with more older than younger members will demand more housing services, and the one with more younger than older members will demand less housing services. For instance, a ten per cent increase in the equivalent household size increases the demand for housing services by seven per cent. The ten per cent increase is equivalent to either a ten or twenty per cent increase in older or younger members respectively in the household. This is so, because an older member is worth a point and a younger member half a point in calculating the

equivalent household size.

Generally a larger household with more old members in it, will tend to have a higher income than the same household with more younger members. The spouse can be more freely engaged in informal employment activities. She could be involved in selling activities at the local market or selling food at construction sites. The older children are then expected to help with household chores. They are also likely to be involved in some informal economic activities. This would further augment the household income and is therefore expected to affect the demand for housing.

For the most part, the spouse's income will probably be expended on food consumption, while that of the household head will be spent on longterm investments like building a kitchen or adding a room to the dwelling.

The demographic coefficients with respect to the stage in the life cycle are all negative. They are also not significantly different from zero at the 95 percent confidence level.

The negative relationship implies that older households demand more housing services than younger households.In this case, households with heads over 50 years old demand more housingthan those with heads less than 50 years old.

Furthermore, with respect to the household heads younger than 30 years and those between 30 and 50 years, the dummy coefficient is nearly the same, 0.3 with a standard errors of 0.3 and 0.2 respectively. Thus households in both life cycle categories shift the vertical intercept by more or less the same amount.

The constant term is positive and significantly different from zero at the 95 percent confidence level as shown in table 7. This might reflect the fact that all the housing areas in the sample had some kind housing services supplied by either the Lusaka City Council or some voluntary organization.

Kaunda Square is supplied with basic services sush as piped water and a sewerage system. Chawama is supplied with public standpipes for every twenty five households. Bauleni has isolated public standpipes which were built by the Lusaka City Council with donations from residents and voluntary organizations. The presence of these services is likely to affect the demand for housing through the constant term.

Furthermore, Chawama is one of the three sites being upgraded by the Lusaka City Council under a joint Zambian gorvernment and World Bank scheme to improve low-income urban housing. The nature of the project, with its subsidized material loans and increased level of social services, is likely to affect the demand for housing in the area.

Thirty seven households, who are owner-occupants were interviewed in Kaunda Square. The average household in Kaunda Square had a monthly income of about 200 dollars with a standard error of 225 dollars. This submarket has a higher mean income than the other submarkets in the sample.

Dwellings in Kaunda Square are also of better quality. In terms of value, they averaged about 5,000 dollars with a standard error of 3,089 dollars.

The average equivalent household size was 5 adults with a standard error of 2 adults.

Eleven percent of the household's heads were less than thirty years old. Nineteen percent were older than fifty years while seventy percent were between 30 and 50 years old.

The estimated income elasticity of demand for Kaunda Square is 0.6 with a standard error of 0.17. The coefficient is significant at the 95 percent confidence level.

The elasticity of the equivalent household size is 0.3 with a standard error of 0.5. The dummy coefficients to the life cycle categories are all negative. This is the same relationship we got for the total sample.

Eighty of the owner-occupant households interviewed came from Chawama. Their average monthly income was 166 dollars with a standard error of 138 dollars, making Chawama a medium income submarket in our sample.

The households lived in dwellings worth about 2,755 dollars with a standard error of 3,526 dollars.

The average equivalent household size was roughly the same as that of Kaunda Square--5 adults with a standard error of 2 adults. However, there were slightly more younger and less older household heads in Chawama and about the same ratio of medium aged households. Thirteen percent of the heads

were younger than 30 years old. Eighteen percent were older than 50 years and 70 percent were between 30 and 50 years old.

The estimated income elasticity of demand for Chawama is 0.7 with a standard error of 0.2. It is significantly different from zero at the 95 percent confidence level.

The coefficient of the equivalent household size is 0.6 and the standard error is 0.2. It proves to be significant at the 95 percent confidence level. Here, we also get a negative coefficient with respect to the stage in the life cycle of the head of the household. The coefficient for household heads between 30 and 50 years old is significant at the 95 percent confidence level.

Bauleni is the poorest housing market and comprised of 40 households in the sample. The monthly income for the average household is 116 dollars with a standard error of 74 dollars. Households lived in dwellings valued at 500 dollars with a standard error of 366 dollars. This is less than a fifth of the average value of the dwellings in the total sample.

However, the average household size is identical to that of Chawama and Kaunda Square households--5 adults and a standard error of 2 adults.

There were more younger and older households and less middle-aged households in Bauleni than in Chawama and Kaunda Square. Eighteen percent of the heads of households were less than 30 years old, 23 percent greater than 50 years and 60 percent between 30 and 50 years old.

The estimated income elasticity of demand for Bauleni is 0.2 with a standard error of 0.2. It is not significant at 95 percent confidence level. The coefficient for the household size is 0.6 with a standard error of 0.3. It is significant at 95 percent confidence level.

In the case of Bauleni, the coefficients with respect to the stage in the life cycle are positive. This is different from what we get from the other

housing submarkets. However, the coefficients are not significant at the 95 percent confidence level.

A COMPARISON OF ELASTICITIES IN THE THREE SUBMARKETS

Households in Kaunda Square are relatively of much higher income than those in either Chawama or Bauleni. Those in Bauleni having the lowest incomes.

Kaunda Square is one of the first sites and service schemes in the country and it was supplied with basic services before residents were allowed to build their own dwellings.

We indicated that Chawama is one of the three sites being upgraded by the Lusaka City Council under the World Bank Scheme. The objective of the Scheme is to give some kind of security of tenure and to provide basic public and social services to the sites to create incentives for upgrading their dwellings.(12)

The estimated income elasticity for the total sample is 0.8. It varies across the three sub-markets. It is 0.7, with a standard error of 0.2 in Chawama. That of Kaunda Square is 0.6 with standard error of 0.2. It is much lower for Bauleni. Its estimated income elasticity and standard error being 0.2 and 0.2 respectively. All income elasticities are significant at the 95 percent confidence level except that for Bauleni.

We should expect the income elasticity for Kaunda Square to be higher than that of Bauleni. As households in Kaunda Square are comparatively of much higher income, it is possible that the proportion of income devoted to housing consumption per proportional increase in income might have declined relatively to those in Chawama. We thus get a lower income elasticity for Kaunda Square than that of Chawama.

The World Bank Scheme in Chawama might also have affected our estimated income elasticity of demand. Given that most households are dependent on wage income. These households see their wage income more or less stable for long periods because of government regulations or Trade Union regulations. The World Bank Scheme in Chawama is likely to have induced households to demand more housing services at each given level of income. It could therefore be possible that the estimated income elasticity could be higher for Chawama than Kaunda Square.

Bauleni has the lowest income elasticity. Most of the owner-occupants here are poor households with an average monthly income of 116 dollars compared to the average monthly income of 163 dollars for the sample of owner-occupants in the three sub-markets. Most households here are more concerned with food consumption. However, it should be noticed that the estimated income elasticity was not significant at the 95 percent confidence level.

Household size is positive and significant for the whole sample of owner-occupants. It is also significant for Chawama and Bauleni, but it is not for Kaunda Square.

The positive effect of household size was expected, but Bauleni and Kaunda Square present themselves as interesting cases.

The estimate of income elasticity for Bauleni is not significant. However, the owner-occupants are very sensitive to household size. On the other hand the effect of household size on owner-occupants in Kaunda Square is not significant. The income elasticity is quite high, though less than that of Chawama.

Kaunda Square has the lowest household size elasticity (0.3 with standard error of 0.5). This implies that households in Kaunda Square demand less housing services as household size increases as compared to households in Chawama

and Bauleni.

Households in Bauleni show that household size is the more important factor than income in the demand for housing services. With a proportionate increase for both income and household size, the proportionate increase in demand for housing is about 30 percent more for household size than for income.

With respect to the stage in the life cycle, the coefficients are on the whole not significant at the 95 percent confidence level.

For the total sample of owner-occupants we get a negative effect for both household heads younger than 30 years and those between 30 and 50 years.

We expected a positive effect for young households. However, since younger households are likely to have unstable employment, they might demand less housing services. This may lead to a negative influence on the demand for housing.

However, the negative relationship we get for households between 30 and 50 years is not only opposite to what we expected, but also interesting. Since these households are likely to have more stable employment than both the younger households and the older households over 50 years old.

For the three submarkets we get negative coefficients for Chawama and Kaunda Square, and positive coefficients for Bauleni. The coefficient for household heads between 30 and 50 years for Chawama is significant at the 95 percent confidence level. The others are not.

The stage of the household head in the life cycle seems to have the same effect on the demand for housing for both Chawama and Bauleni. In Kaunda Square elderly households between 30 and 50 years seem to have a larger effect than younger households less than 30 years old.

The coefficient for the constant term is both positive and significant at the 95 percent confidence level for both the whole sample and the three sub-

markets. The coefficient for Kaunda Square is the highest, perhaps reflecting the level of services provided there. However, the coefficient for Bauleni is higher than that for Chawama, yet Chawama is supplied with services and Bauleni is not.

We noted that Bauleni has public standpipes erected by the Lusaka City Council through voluntary efforts of the community and charitable organizations. If the availability of water has a positive influence on home improvement, it is likely that the availability of water in Bauleni had a big effect on the demand for housing. This may suggest that poor neighborhoods are more responsive to basic services than are richer neighborhoods.

TABLE 6

HOUSEHOLD CHARACTERISTICS OF OWNER-OCCUPANTS:

VARIABLE MEANS AND STANDARD DEVIATIONS

Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Sample Size	157	80	40	37
Equivalent Household Size	5.26 (2.03)	5.38 (2.17)	5.06 (2.16)	5.22 (1.52)
Monthly Income U.S. $	162.50 (153.77)	166.30 (137.78)	116.49 (73.88)	204.04 (225.26)
Household Head Less Than 30 Years	0.13 (0.34)	0.13 (0.33)	0.18 (0.38)	0.11 (0.31)
Household Head Greater Than 50 Years	0.19 (0.39)	0.18 (0.38)	0.23 (0.42)	0.19 (0.4)
Household Head Between 30 and 50 Years	0.68 (0.47)	0.70 (0.46)	0.60 (0.50)	0.70 (0.46)
Value of the Dwelling U.S. $	2,792.89 (3,382.32)	2,754.91 (3,526.42)	498.73 (365.84)	5,355.18 (3.088.7

Source: Tabulated from Home Improvement Survey (1979) data
* Standard deviations in parantheses

TABLE 7

REGRESSION OF PROPERTY VALUE ON INCOME AND DEMOGRAPHIC VARIABLES:

CONSTANT ELASTICITY MODEL

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Logarithm Monthly Income	0.78* (0.13)	0.74* (0.17)	0.15 (0.17)	0.60* (0.17)
Logarithm Equivalent Household Size	0.67* (0.20)	0.64* (0.22)	0.57* (0.25)	0.28 (0.46)
Household Head Less Than 30 Years	-0.28 (0.33)	-0.48 (0.40)	0.18 (0.38)	-0.05 (0.50)
Household Head Between 30 and 50 Years	-0.27 (0.23)	-0.55* (0.28)	0.22 (0.26)	-0.48 (0.34)
Constant	2.54* (0.65)	3.04* (0.79)	4.07* (0.81)	5.16* (1.25)
Sample Size	157	80	40	37
R^2 (adjusted)	0.25	0.32	0.10	0.19
F Statistic	13.95	10.16	2.09	3.08

Source: Equation (1) estimated with data from Home Improvement Survey (1979) with owner-occupant households.

Note: 1. Standard errors of coefficients in parentheses
2. *Coefficient significantly different from zero at 95 percent confidence level

OWNER-OCCUPANT HOUSEHOLDS WITH AND WITHOUT LODGERS

Low-income households are likely to start up with a one-roomed unit. Later, they can add another room because they have either saved enough or have had a windfall income from a relative. The rental income from the additional room is likely to be used to improve the dwelling. The demand for housing for such households is likely to be different from other households. We therefore decided to distinguish between those households with lodgers and those without.

Eighty two percent of the households, who are owner-occupants, had no lodgers, while 18 percent had lodgers. The characteristics of both types of households in the sample is shown in table 8.

Households with lodgers had a monthly income of 181 dollars, with a standard error of 188 dollars. They lived in dwellings with an average value of 3,600 dollars with a standard error of 3,582 dollars. This value is greater than the mean value of the total sample of owner-occupants.

The average equivalent household size is five adults with a standard error of 2 adults. In 28 percent, 52 percent and 21 percent of the households, the household heads were less than 30, between 30 and 50 and greater than 50 years respectively. Most of the households with lodgers, had middle-aged household heads.

Households without lodgers had lower incomes than those with lodgers. Their average monthly income was 158 dollars with a standard error of 145 dollars. The average value of their dwellings was lower, both in terms of the households with lodgers and the total sample of owner-occupants. They occupied dwellings with a mean value of 2,600 dollars with a standard error of 3,300 dollars.

The average equivalent household size is similar to that of households with lodgers. It is five adults with a standard error of 2 adults. Also most of the household heads were middle-aged--between 30 and 50 years old. Ten percent, 71 percent and 19 percent of the household heads were less than 30, between 30 and 50

TABLE 8

CHARACTERISTICS OF OWNER-OCCUPANT HOUSEHOLDS WITH AND WITHOUT LODGERS: VARIABLE MEANS AND STANDARD DEVIATIONS

Variable	Total Sample	Households with Lodgers	Households Without Lodgers
Sample Size	157	29	128
Equivalent Household Size	5.26 (2.03)	5.34 (2.43)	5.24 (1.93)
Monthly Income U.S. $	162.50 (153.77)	180.88 (188.12)	158.34 (145.43)
Household Head Less than 30 Years	0.13 (0.34)	0.28 (0.45)	0.10 (0.30)
Household Head Greater Than 50 Years	0.19 (0.39)	0.21 (0.41)	0.19 (0.39)
Household Head Between 30 and 50 Years	0.68 (0.47)	0.52 (0.51)	0.71 (0.46)
Value of The Dwelling U.S. $	2,792.89 (3,382.32)	3,590.05 (3,582.22)	2.612.28 (3,323.43)

Source: Tabulated from Home Improvement Survey (1979) data

Note: 1. Standard deviations in parenthesis

and greater than 50 years old.

It is therefore apparent that most of the households with lodgers had higher incomes, lived in higher valued dwellings and their household heads were middle-aged. The household size is similar between them.

Table 9 shows the estimated coefficients for the total sample of owner-occupants broken down into those with lodgers and those without lodgers. There is no difference between the income elasticity for households with lodgers and those without lodgers. The former gives us an income elasticity of 0.8 with a standard error of 0.3. The latter gives us 0.8 with a standard error of 0.2. Both coefficients are significantly different from zero at the 95 per-cent confidence level.

This result is very interesting. It suggests that demand elasticities do not differ between the two types of households, while we expected those households with lodgers to have higher elasticities than those without lodgers.

The pattern of the other coefficients is also the same. The coefficients for the household size and with respect to the stage of the household head in the life-cycle are alike.

TABLE 9
REGRESSION OF PROPERTY VALUE ON INCOME AND DEMOGRAPHIC VARIABLES BY LODGER CATEGORY: CONSTANT ELASTICITY MODEL

INDEPENDENT VARIABLE	TOTAL SAMPLE	HOUSEHOLDS WITH LODGERS	HOUSEHOLDS WITHOUT LODGERS
Logarithm Monthly Income	0.78* (0.13)	0.75* (0.30)	0.79* (0.15)
Logarithm Equivalent Household Size	0.67* (0.20)	0.73 (0.41)	0.65* (0.24)
Household Head Less Than 30 Years	-0.28 (0.33)	- -	-0.55 (0.39)
Household Head Greater Than 50 Years	- -	-0.07 (0.66)	- -
Household Head Between 30 and 50 Years	-0.27 (0.23)	- .27 (0.53)	-0.28 (0.26)
Constant	2.54* (0.65)	2.91* (1.39)	2.49* (0.74)
Sample Size	157	29	128
R^2 (Adjusted)	0.25	0.23	0.23
F - Statistic	13.95	3.09	10.72

Source: Equation (1) estimated with data from Home Improvement Survey (1979) with Owner-Occupant Households.

Note: 1. Standard errors of coefficients in parentheses
2. *Coefficient significantly different from zero at 95 percent confidence level

OWNER-OCCUPANT HOUSEHOLDS AT DIFFERENT LEVELS OF EDUCATION

We also divided the total sample of owner-occupant households into two groups. The first group consisted of households whose head had seven or less years of schooling. The second group was composed of households with 8 to 12 years of schooling.

The household characteristics of these two groups are shown in table 10. We can see that 58 percent of the households had 7 or less years at school. Most of these households were middle-aged--65 percent. They had a monthly income of 124 dollars and lived in a dwelling worth 2,570 dollars.

Thirty-four percent of the households had 8 to 12 years at school. They earned more monthly income and their dwellings were worth more--196 and 2,726 dollars respectively. Most of these households were either young or middle-aged.

Table 11 shows the estimated coefficients for the total sample of owner-occupants grouped into those with less than 7 years of school and those with 8 to 12 years of school. We get an income elasticity of 0.9 with a standard error of 0.2 for these households with less education. Households with more education give us an income elasticity of 0.6 with a standard error of 0.2. Both coefficients are significant at the 95 percent confidence level.

We therefore get, for those households with less than 7 years of education, a higher income elasticity than for those who had more years of education. The latter group is likely to be younger, while the former is likely to be old. The older households, though comparatively earning less income because of less education, are likely to be more stable both in terms of income and planning horizon. This is likely to affect their demand for housing, making their income elasticity higher than that for younger households.

The household size elasticity is similar to that of the whole sample, al-

though that of the more educated households is slightly higher (See table 11).

It therefore appears that households with less education have a higher income elasticity of demand for housing then households with less education. It is difficult to see why but age is likely to be a key factor in the explanation.

TABLE 10

CHARACTERISTICS OF OWNER-OCCUPANT HOUSEHOLDS AT DIFFERENT LEVELS OF EDUCATION: VARIABLE MEANS AND STANDARD DEVIATIONS.

Variable	Total Sample	Households With 0-7 Years of School	Households With 8-12 Years of School
Sample Size	157	91	53
Equivalent Household Size	5.26 (2.03)	5.35 (2.02)	5.22 (2.16)
Monthly Income U.S. $	162.50 (153.77)	123.97 (82.54)	196.08 (155.56)
Household Head Less Than 30 Years	0.13 (0.34)	0.03 (0.18)	0.30 (0.46)
Household Head Between 30 and 50 Years	0.68 (0.47)	0.65 (0.48)	0.70 (0.46
Household Head Greater than 50 Years	0.19 (0.39)	0.32 (0.47)	- -
Value of the Dwelling U.S. $	2,792.89 (3,382.32)	2,569.06 (3,415.47)	2.725.82 (3,296.85)

Source: Tabulated from Home Improvement Survey Data (1979)

Note: 1. Standard deviations in parentheses

TABLE 11

REGRESSION OF PROPERTY VALUE ON INCOME AND DEMOGRAPHIC VARIABLES BY EDUCATIONAL CATEGORY: CONSTANT ELASTICITY MODEL

Independent Variable	Total Sample	Household Head With Less Than 7 Years of School	Household Head With 8 to 12 Years of School
Logarithm Monthly Income	0.78* (0.13)	0.90* (0.19)	0.61* (0.24)
Logarithm Equivalent Household Size	0.67* (0.20)	0.67 (0.31)	0.75* (032)
Household Head Less Than 30 Years	-0.28 (0.33)	0.50 (0.78)	-0.21 (0.34)
Household Head Between 30 and 50 Years	-0.27 (0.23)	-0.35* (0.31)	- -
Constant	2.54* (0.65)	2.0* (0.90)	2.95* (1.28)
Sample Size	157	91	53
R^2	0.25	0.27	0.16
F - Stastic	13.95	9.48	4.26

Source: Equation (1) estimated with data from Home Improvement Survey (1979) With Owner Occupant Households.

Note: 1. Standard error of coefficients in parentheses
2. *Coefficient significently different from zero at 95 percent confidence level.

CONCLUSION

Urban areas in Zambia are experiencing severe housing problems. The solution of these problems has been made difficult by the scarcity of resources. The need for accurate estimates of the response of housing demand to changes in income is therefore very great.

Reliable elasticity estimates are needed for forcasting housing demand and for formulating urban policies. However, one important question arises: Do the estimated elasticity values reflect the reactions of consumers in the future? The answer to this question means that the estimated coefficients are not exact values and that they only need to be stable to be assumed to reflect the reaction of consumers in the future.

Our empirical study shows that the estimated income elasticity is less than one. This finding agrees with studies elsewhere both in the developed and developing countries.

We also found that the estimated elasticity varies acrosss submarkets. However the coefficient was similar for households who had taken in lodgers and those who had not. These households with less education had a higher income elasticity than those with more education.

APPENDIX

Linear Model:

An alternative functional form for estimating income elasticity is the linear model. The advantage of this specification is that the estimated elasticity varies with income. In this paper we estimate the income elasticity at the average income for the sample. So we estimate the linear model;

$$P = a_0 + a_I A + a_2 Y + a_3 D_I + a_4 D_2 \qquad (2)$$

We define income elasticity as:

$$e_y = dp / dy . y / p = a_2 . y_0 / p_0$$

Where: $dp / dy = a_2$

y_0 is the average income for the sample

p_0 is the average value of the dwelling.

From regression equation (2)

$a_2 = 8.80$

$y_0 = \$162.50$

$p_0 = \$2,792.89$

$$e_y = 8.80 \times \frac{162.50}{2,792.89}$$

$$= 0.51$$

The results of regression equation (2) for the total sample and the three submarkets are given in table 12. The calculated elasticities are shown in table 13.

We get an estimated income elasticity of 0.5 for the total sample. This is lower than that for the constant elasticity model - (0.8). The income elasticity is significant at the 95 percent confidence level.

The estimated income elasticity is 0.6 for Chawama, 0.2 for Kaunda Square and Bauleni. Those for Kaunda Square and Chawama are significant at the 95 percent level of confidence.

The pattern of the coefficients for the linear model is similar in the three markets as that of the constant model. We get the highest income elasticity for the Chawama submarket. However, the linear model gives us similar elasticities for Bauleni and Kaunda Square.

Furthermore, the estimated income elasticity is the same for the Bauleni submarket for both the constant and linear elasticity model. The one for Kaunda Square estimated from the constant model is higher than that estimated from the linear model - 0.6 and 0.2 respectively.

The household size elasticities are all lower than those from the constant elasticity model except that for the Chawama submarket.

The adjusted R^2 was quite low for the regression equation in both the Kaunda Square and Bauleni submarkets. It was zero for Bauleni and 0.02 for Kaunda Square.

TABLE 12

REGRESSION OF PROPERTY VALUE ON INCOME AND DEMOGRAPHIC VARIABLES: LINEAR MODEL

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Monthly Income	8.80* (1.61)	9.51* (2.57)	0.80 (23.83)	5.17* (291.74)
Equivalent Household Size	247.40* (98.20)	344.45* (128.11)	33.64 (23.83)	107.03 (291.74)
Household Head Less Than 30 Years	-561.82 (708.55)	86.11 (848.24)	101.47 (163.23)	299.00 (1622.85)
Household Head Greater Than 50 Years	- -	1597.72 (738.53)	- -	- -
Household Head Between 30 and 50 Years	-789.92 (513.42)	- -	82.77 (117.11)	-406.22 (1105.14)
Constant	383.97 (755.56)	-1216.66 (796.62)	82.40 (182.95)	3091.85 (2099.45)
Sample Size	157	80	40	37
R^2 (Adjusted)	0.18	0.23	0	0.02
F Statistic	9.42	6.89	0.87	1.13

Source: Equation (2) estimated with data from Home Improvement Survey (1979) With Owner-Occupied Households.

Note: 1. Standard errors of coefficients in parentheses.
2. *Coefficient significantly different from zero at 95 percent confidence level.

TABLE 13

ESTIMATED ELASTICITIES: LINEAR MODEL

Coefficient	Total Sample	Chawama	Bauleni	Kaunda Square
Income Elasticity	0.51	0.57	0.19	0.20
Household Size Elasticity	0.47	0.67	0.34	0.10

Calculated from table 12 and table 6 at the mean level.

LOG - EXPONENTIAL MODEL.

We also use the log-exponential form to estimate income elasticity. The previous functional forms we used--the linear and the constant elasticity--restrict the income elasticity. The constant elasticity model assumes a constant coefficient. The linear model makes the coefficient change with income. The log-exponential form allows the income elasticity to change linearly with income. It is therefore different at every level.

Our specification for the model is :

$$\text{Ln } P = a_0 + a_I \ln A + a_2 A + a_3 \ln Y + a_4 Y + a_5 D_I + a_6 D_2 \qquad (3)$$

The estimated income elasticity can be defined as:

$$e_y = a_3 + a_4 Y$$

Where $a_3 = d \ln P / d \ln Y$ $\qquad a_4 = d \ln P / dY$

Let $y = y_0$, the average income for the sample

From regression equation (3)

$a_3 = 0.83 \qquad a_4 = -0.0003$

$y_0 = \$162.50$

$e_y = 0.83 - 0.05$

$= 0.78$

The estimated coefficients from this functional form are given in Table 14. The estimated elasticities are given in Table 15. The coefficients are not very different between the constant elasticity and the log-exponential models for both the total sample and the three subsamples. They are all higher than those of the linear model.

TABLE 14

REGRESSION OF PROPERTY VALUE ON INCOME AND DEMOGRAPHIC VARIABLES: LOG-EXPONENTIAL MODEL

Dependent Variable	Total Sample	Chawama	Kaunda Square	Bauleni
Logarithm Monthly Income	0.83* (0.25)	1.21* (0.35)	0.85* (0.31)	-0.10 (0.59)
Monthly Income	-0.0003 (0.001)	-0.003 (0.002(	-0.001 (0.001)	0.003 (0.006)
Logarithm Equivalent Household Size	0.64 (0.57)	-0.20 (0.60)	0.66 (2.75)	0.62 (0.77)
Equivalent Household Size	0.01 (0.13)	0.18 (0.13)	-0.09 (0.53)	-0.01 (0.16)
Household Head Less Than 30 Years	-0.29 (0.33)	-0.57 (0.40)	-0.05 (0.51)	0.21 (0.41)
Household Head Between 30 and 50 Years	-0.27 (0.24)	-0.50 (0.28)	-0.50 (0.35)	0.22 (0.27)
Constant	2.39* (0.96)	1.54 (1.32)	4.00 (2.19)	4.84 (1.91)
Sample Size	157	80	37	40
R^2 (adjusted)	0.24	0.33	0.16	0.05
F - Statistic	9.19	7.42	2.16	1.36

Source: Equation (3) estimated with data from Home Improvement Survey (1979) with Owner-Occupant Households

Note: 1. Standard errors of coefficients in parentheses
2. *Coefficient significantly different from zero at 95 percent confidence level

TABLE 15

ESTIMATED ELASTICITIES: LOG-EXPONENTIAL MODEL

Coefficient	Total Sample	Chawama	Bauleni	Kaunda Square
Income Elasticity	0.78	0.73	0.22	0.59
Household Size Elasticity	0.67	0.79	0.59	0.22

Calculated from Table 14 and Table 6 at the mean level.

III. AN ANALYSIS OF THE RELATIVE VALUE OF A HOUSE

For our analysis of the attributes of a dwelling, we use a hedonic regression of property value on the characteristics of a dwelling for the total sample and in each housing sub-market.

The hedonic index reflects the interaction of supply and demand in the market for the bundle of characteristics. The hedonic regression will give us marginal prices of the dwelling attributes.(12)

We use three functional forms for the regression - the log-linear, linear and the log-exponential form. We discuss the constant elasticity model here. The other functional forms are relegated to the appendices.

Our regression equation will take the form:

$$\text{Ln } P = a + b_1 \ln F + b_2 \ln N + b_3 \ln R + b_4 \ln T + b_5 \ln Y + b_6 D_1 + b_7 D_2 + b_8 D_3 + b_9 D_4 + b_{10} D_5 + b_{11} D_6 . \qquad (4)$$

Where:

P = value of the dwelling

F = floorspace area of the dwelling

N = age of the dwelling

R = number of rooms in the dwelling

T = time to work

Y = area of the lot

D_1 = 1 better neighborhood water; 0 otherwise

D_2 = 1 better wall materials; 0 otherwise

D_3 = 1 better roof materials; 0 otherwise

$D_4 = 1$ better toilet facilities; 0 otherwise

$D_5 = 1$ neighborhood effect; 0 otherwise

$D_6 = 1$ plaster and paint; 0 otherwise

Value of the Dwelling Unit

The average value of the dwelling was $2,975 for the total sample. Kaunda Square had better dwellings where the average value of the dwelling was $5400. Bauleni had worse dwellings with an average value of $500. The dwellings in Chewama were about average with a mean value of $2,951.

Floorspace Area of the Dwelling

The mean floorspace area of the whole sample was 106 square metres with a standard deviation of 95 square metres. The average floor area varied across the submarkets. Dwellings in Kaunda Square had the largest floor area. Those in Bauleni had the smallest. However, the variation in the floor area was largest in Bauleni. (See Table 16)

It is expected that the larger the floorspace of the dwelling the higher is the implicit price. We obtained a negative marginal price from our regression equation for the total sample, giving us an opposite relationship from that we expected. The marginal price for the total sample was 0.02 with a standard error of 0.12.

We also got a negative marginal price for the Chawama and Bauleni submarkets. The marginal price for Chawama is slightly higher (0.08) than that for Bauleni (0.03).

We get a positive marginal price for the Kaunda Square submarket. Also the coefficient is much higher than for the other submarkets (0.05). However,

all the coefficients were not significant at the 95 percent confidence level.

A survey by the National Housing Authority in low-income housing areas revealed that questions to respondents of the survey about the way the dwelling "worked" were not meaningful. Most households were prepared to accept temporary inconveniences in terms of space,--such as having to sit outside when it is very hot or having to put the children to sleep in the kitchen. These were regarded as normal and are likely to affect the demand for space.(13)

However, it is likely that as the income of the household improves, space is likely to become more important. Thus we get the positive relationship for the Kaunda Square submarket.

Number of Rooms

The average number of rooms per dwelling for the total sample was three rooms. This is about the same for Chawama and Bauleni. Kaunda Square has on average more rooms--four rooms, than the other submarkets.

With the rapid pace of urbanization in Zambia and the associated massive influx of the economically weak migrants from rural areas, overcrowding is expected in terms of spatial density and the number of rooms in each household.

However, studies carried out by the Lusaka Housing Project Unit show that overcrowding is higher in low-income formal housing areas (e.g. council houses) than it is in the informal housing areas. This is probably because households in informal housing areas can easily add on another room. This is not possible with council houses. One has to go back to the council and que to satisfy such a need.

The number of rooms in a dwelling is therefore likely to be highly valued by the low-income households. Our empirical evidence confirms this. We get positive marginal prices for number of rooms.

The coefficients are significant at 95 percent confidence level, except that for Kaunda Square.

Age of the Dwelling

The average age of the dwelling units for the total sample was about six years. The oldest units were in Bauleni. Kaunda Square and Chawama had dwelling units of about the same age.

We expected age to contribute less to the value of a dwelling. We therefore expected a negative relationship between the value of a house and its age. We got the postulated relationship for the total sample and the three housing areas. However, all the coefficients are insignificant at the 95 percent confidence level.

Travel Time To Work

We used the amount of time spent going to work by the head of the household to measure the importance of the household's accessibility to his workplace.

On the average households spent about 43 minutes going to their workplaces. This varied greatly for the separate housing markets. Households in Chawama spent about 43 minutes, those in Kaunda Square spent 32 minutes, and those in Bauleni spent nearly a full hour on their way to work.

We expect to get a negative relationship between the value of the house and its accessibility. We get the postulated relationship from our regression for the total sample, Kaunda Square and Bauleni. We get a positive relationship for Chawama.

The estimated coefficients seem to be quite low for all submarkets, except for Kaunda Square. For the workers who work in the formal sector, the institution of employers providing free transport to and from work is likely to reduce the importance of the work accessibility attribute.

Area of the Lot

The mean area of the lot was 545 square metres with a standard deviation of 385 square metres. The largest lots were in Bauleni. It is possible the size of lots were exaggerated in Bauleni because landownership is not clear. Consequently the lots are not clearly demarcated.

The marginal price of site areas is positive except that for Kaunda Square. However, most households in Kaunda Square complained about the size of the site on which their dwellings are built. This is likely to affect their marginal evaluation of the site area. But such significance is still expected to be positive.

Neighborhood Water

About 24 percent of the dwellings had better neighborhood water--those who had their own piped water. However, nearly all the dwelling units in Kaunda Square have in-door piped water and nearly all in Bauleni and Chawama had none. This is likely to make our marginal prices for this dwelling attribute less interesting.

Nevertheless, the influence of better neighborhood water gives us positive marginal prices for the total sample and the Chawama submarket. We get a negative marginal price for the Kaunda Square submarket.

Roof and Wall Materials

Most of the dwellings had better roof materials in nearly all subsamples. However, fewer dwellings had better wall materials, except for Kaunda Square.

TABLE 16

DWELLING ATTRIBUTES: VARIABLE MEANS AND STANDARD DEVIATIONS

Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Sample Size	139	74	32	33
Value of the Dwelling (U.S. $)	2975.14 (3461.60)	2951.42 (3607.62(	528.48 (386.52)	5400.84 (3128.10)
Floor Area of The Dwelling (M^2)	105.58 (95.32)	110.92 (104.12)	85.56 (106.03)	113.03 (55.09)
Age of the Dwelling (Years)	5.72 (3.58)	5.25 (3.68)	7.09 (4.13)	5.42 (2.35)
Number of Rooms	3.45 (1.42)	3.41 (1.43)	2.8 (1.35)	4.15 (1.18)
Travel Time To Work	42.96 (29.75)	42.35 (29.68)	55.81 (30.98)	31.88 (24.19)
Area of the Lot (M^2)	545.02 (385.31)	477.49 (160.20)	921.19 (617.87)	331.70 (113.60)
Neighborhood Water	0.24 (0.43)	0.01 (0.12)	- -	0.97 (0.17)
Better Wall Materials	0.67 (0.47)	0.80 (0.40)	0.03 (0.18)	1.0 (0)
Better Roof Materials	0.99 (0.08)	1.00 0	1.0 0	0.97 (0.17)
Better Toilet Facilities	0.24 (0.43)	- -	- -	1.0 (0)
Neighborhood Effect	1.87 (1.26)	1.95 (1.19)	1.97 (1.38)	1.6 (1.27)
Plaster & Paint	0.54 (0.50)	0.53 (0.50)	0.41 (0.50)	0.70 (0.47)

Source: Tabulated from Home Improvement Survey (1979) data

Note: 1. Standard deviations in parentheses

Apparently concrete wall materials and asbestos roofing are common to most households. Some of the concrete blocks are made in the housing areas, while some are bought from the building material stores belonging to the Lusaka City Council where there is a project going on like in Chawama.

Households tend to prefer asbestos roofing if they can afford them because of the protection from the heat during the hot season. However, households are worried about roof leaks and cracks in the wall structure of their dwellings.

We expected a positive coefficient for the better walls and roof structure of the dwellings. The marginal price for wall materials is positive for the total sample and the submarkets of Chawama and Bauleni. The coefficients were significant at the 95 percent level of confidence. However, the marginal price for roof materials was negative for the total sample and the Kaunda Square market. They were also not significant at the 95 percent confidence level. This is opposite to what we expected. Disatisfaction from roof leaks could be a factor contributing to the negative coefficients.

Sanitary Facilities

Most of the dwellings did not have better sanitary facilities. They used pit latrines and shared with neighbors. The 24 percent of the households who had better sanitary facilities all lived in Kaunda Square. These facilities were much better and had running water. Nearly all the households without better sanitary facilities were disatisfied by the condition of their sanitary facilities. In Chawama, where there was a Lusaka City Council project going on, most respondents would have liked the council to intervene more directly in the erection of toilet facilities than in anything else. This shows the significance that respondents attach to better sanitary facilities.

The marginal price we get for better sanitary facilities is negative.

This is interesting since it is different from the postulated positive coefficient. However, it is possible that the coefficient reflects more the Kaunda Square residents who seem to have already attained satisfactory sanitary conditions.

Neighborhood Effect

Respondents were asked to rate their neighbors according to income. On this basis the neighborhood effect on the value of the dwelling was determined. This gave us negative prices for the total sample and the submarkets of Chawama and Bauleni. The Kaunda Square submarket gave us a positive marginal price. All coefficients were not significant at the 95 percent confidence level. However, the coefficients are quite low giving us little effect on the value of the dwelling.

Plaster and Paint

About 54 percent of the dwellings are either plastered or painted or both. It can be argued that appearance of a dwelling has high marginal significance in low-income housing areas.

Because much of the day is spent outside the dwelling, it is possible that functional aspects of housing can have lower marginal significance to that of the appearance of the house.

Part of this is a result of the demonstration effect of high income housing.

A study by the National Housing Authority showed that households in site and service schemes would rather spend their income on the surface appearance of the dwelling, than more space. The most common example of such surface embellishment is painting, e.g., painting the porch, painting figures or flowers

on the walls.[14]

In our regression the marginal price of plaster and paint is positive. It is significant at 95 percent level of confidence for the total sample and the submarkets, except for Bauleni.

TABLE 17

REGRESSION OF PROPERTY VALUE ON ATTRIBUTES OF A DWELLING: LOG-LINEAR MODEL

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Logarithm Floor Area of the Dwelling	-0.02 (0.12)	-0.08 (0.17)	-0.03 (0.20)	0.46 (0.41)
Logarithm Age of the Dwelling	-0.10 (0.11)	-0.21 (0.17)	-0.0003 (0.22)	-0.29 (0.28)
Logarithm Number of Rooms	1.04* (0.18)	1.20* (0.25)	0.90* (0.30)	0.91 (0.49)
Logarithm Travel Time To Work	-0.08 (0.07)	0.14 (0.12)	-0.15 (0.16)	-0.32* (0.12)
Logarithm Area of the Lot	0.13 (0.12)	0.13 (0.20)	0.17 (0.17)	-0.54 (0.49)
Neighborhood Water	0.42 (0.48)	1.36 (0.75)	- -	-0.45 (0.68)
Wall Materials	1.39* (0.16)	1.18* (0.26)	2.03* (0.63)	- -
Roof Materials	-0.25 (0.69)	- -	- -	-0.34 (0.86)
Toilet Facilities	-0.01 (0.48)	- -	- -	- -
Neighborhood Effect	-0.01 (0.05)	-0.02 (0.07)	-0.03 (0.08)	0.03 (0.09)
Plaster & Paint	0.50* (0.12)	0.68* (0.17)	0.06 (0.23)	0.70* (0.31)
Constant	4.99* (1.12)	5.28* (1.54)	4.46* (1.22)	9.05* (2.33)
Sample Size	139	74	32	33
R^2 (adjusted)	0.73	0.62	0.31	0.43
F - Statistic	34.74	14.41	2.74	3.66

Source: Equation (4) estimated with data from Home Improvement Survey (1979)
Note: 1. Standard errors of coefficient in parentheses
2. *Coefficient significantly different from zero at 95 percent confidence level

Conclusion

A study of the relationship between the value of a dwelling and its attributes is an important contribution to the recent concern about low-income housing in low-income countries. A clearer understanding of this empirical relationship should help public agencies to identify which elements of the dwelling public policy should focus on when trying to help occupants to improve their dwellings.

Our regression analysis attempts to identify such dwelling attributes which could be susceptible to public policy.

The number of rooms, the area of the site, neighborhood water, wall materials and, plaster and paint gave us positive marginal prices. This is the relationship we postulated.

The number of rooms, wall materials and plaster and paint were significant at the 95 percent confidence level.

The age of the dwelling and the travel time to work gave us negative marginal prices. This is also what we had postulated. The coefficients were not significant at the 95 percent confidence level.

On the other hand, the floor space area of the dwelling, the neighborhood effect, roof materials and toilet facilities gave us negative marginal prices. This is opposite to what we expected. The coefficients were not significant at the 95 percent level of confidence.

However, it might be noticed that the marginal price for floorspace area of the dwelling was positive for the Kaunda Square submarket. This might mean that the marginal valuation for increased floorspace increases with income.

The coefficients for the neighbor/hood effect are quite low. This might indicate the low importance attached to the quality of the neighborhood in terms of the value of the dwelling compared to other attributes.

For roof materials and toilet facilities we get uniform characteristics for Chawama and Bauleni. The negative marginal prices we get for Kaunda Square is likely to reflect the lower significance attached to the comparatively higher level of sanitary facilities.

It is difficult to overemphasize the importance of housing in low-income countries. The persistent severe housing problems, the scarcity of resources and the legacy of government intervention in the housing market in favor of high income groups require more solid and correct estimates of the response of housing demand to changes in income and prices. This is especially so because of the rapid urbanization process coupled with high income and population growth low income countries are going through. This is especially true for our case study--Zambia.

Hedonic index analysis and reliable elasticity estimates are needed for the formulation of sound urban policies and forecasting housing demand.

Appendix

For our study of the value of the dwelling we also looked at the dwelling characteristics using two other functional forms--the linear and the log-exponential. The results of the regressions of these forms are given in table 18 and 19. In table 20 we compare the hedonic prices of the continuous variables from the three functional form. The pattern of coefficients is not very different from each form. However, the log-exponential form gives us a positive marginal price for the floor area of the dwelling. The other two forms give us negative marginal prices.

For the linear model we have the functional form:

$$P = a + b_1 F + b_2 N + b_3 R + b_4 T + b_5 Y + b_6 D_1 + b_7 D_2 + b_8 D_3 + b_9 D_4 + b_{10} D_5 + b_{11} D_6 \qquad (5)$$

Where the continuous and dummy variables are as in equation (4).

The marginal price of a dwelling attribute is defined as:

$$z = b_I \, F / P$$

Where F is the mean floorspace area of the dwelling

P is the average value of the dwelling and b_1 is a floorspace coefficient.

$$\therefore z = -0.51 \times \frac{105.58}{2975.14}$$

$$= -0.02$$

For the log-exponential model we have the form

$$\ln P = a + b_1 \ln F + b_2 F + b_3 \ln N + b_4 N + b_5 \ln R + b_6 R + b_7 \ln T +$$

$$b_8 T + b_9 \ln Y + b_{10} Y + b_{11} D_1 + b_{12} D_2 + b_{13} + b_{14} D_4 + b_{15} D_5 +$$

$$B_{16} D_6 \qquad (5)$$

Where the continuous and dummy variables are as in equation (4)

The marginal price of a dwelling attribute z is defined as:

$$z = b_1 + b_2 F$$

Where F is the mean floorspace area of the dwelling b_1, b_2 are coefficients

$$\therefore z = 0.11 + (-0.001 \times 105.58)$$

$$= 0.004$$

TABLE 18

REGRESSION OF PROPERTY VALUE ON ATTRIBUTES OF A DWELLING: LINEAR MODEL

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Floor Area of the Dwelling	-0.51 (2.04)	-2.21 (3.05)	-0.18 (0.51)	6.45 (8.80)
Age of The Dwelling	-79.40 (55.23)	-145.04 (98.82)	-8.08 (12.63)	-127.73 (175.22)
Number of Rooms	674.75* (146.56)	886.93* (210.99)	88.32* (42.40)	646.44* (382.08)
Travel Time To Work	-8.00 (5.82)	4.86 (8.90)	-1.62 (1.64)	-42.82* (14.81)
Area of the Lot	0.26 (0.49)	0.36 (1.65)	0.12 (0.08)	-2.74 (3.95)
Neighborhood Water	2590.91 (1427.56)	6112.53* (2343.24)	- -	-1057.94 (2074.50)
*Wall Materials	1541.84* (482.99)	960.07 (887.49)	1282.82* (249.29)	- -
Roof Materials	833.80 (1998.99)	- -	- -	364.31 (2257.47)
Toilet Facilities	-1680.36 (1440.41)	- -	- -	- -
Neighborhood Effect	-152.84 (133.71)	-195.34 (224.95)	-17.55 (32.89)	159.01 (289.77)
Plaster & Paint	1553.39* (349.66)	1822.93* (529.94)	18.03 (87.87)	2835.06* (963.71)
Constant	694.76 (2460.96)	4626.48 (2763.49)	207.80 (142.03)	1205.18 (2178.79)
Sample Size	139	74	32	33
R^2 (Adjusted)	0.51	0.44	0.42	0.42
F - Statistic	14.02	7.32	3.79	3.61

Source: Equation (5) estimated with data from Home Improvement Survey (1979)

Note: 1. Standard errors of coefficients in parentheses
2. *Coefficients significantly different from zero at 95 percent confidence level

TABLE 19

REGRESSION OF PROPERTY VALUE ON ATTRIBUTES OF A DWELLING: LOG-EXP MODEL

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Logarithm floor area of the dwelling	0.11 (0.24)	-0.06 (0.33)	0.20 (0.44)	2.31 (1.97)
Floor area of the dwelling	-0.001 (0.002)	0.0002 (0.002)	-0.001 (0.003)	-0.01 (0.01)
Logarithm age of the dwelling	0.19 (0.31)	0.78 (0.54)	0.30 (0.60)	-0.59 (0.82)
Age of the dwelling	-0.06 (0.05)	-0.19* (0.09)	-0.05 (0.09)	0.01 (0.17)
Logarithm number of rooms	1.77* (0.61)	2.29* (1.01)	1.99 (1.01)	-1.87 (4.30)
Number of rooms	-0.24 (0.18)	-0.30 (0.28)	-0.53 (0.37)	0.72 (1.14)
Logarithm travel time to work	-0.13 (0.16)	0.62* (0.30)	-0.51 (0.37)	-0.54 (0.34)
Travel time to work	0.001 (0.004)	-0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Logarithm area of the lot	-0.12 (0.24)	-0.17 (0.86)	-0.44 (0.46)	0.67 (1.55)
Area of the lot	0.0004 (0.0003)	0.0003 (0.002)	0.001 (0.001)	-0.01 (0.01)
Neighborhood water	0.36 (0.49)	1.79* (0.78)	- -	-.43 (0.74)
Wall materials	1.33* (0.17)	0.90* (0.29)	1.86* (0.66)	- -
Roof materials	-0.54 (0.73)	- -	- -	-0.03 (2.03)
Toilet facilities	-0.02 (0.49)	-	-	-
Neighborhood effect	-0.01 (0.05)	-0.08 (0.07)	0.03 (0.09)	0.002 (0.11)
Plaster and paint	0.50* (0.12)	0.55* (0.18)	0.09 (0.22)	0.78 (0.39)
Constant	5.70* (1.49)	5.19 (4.47)	7.99* (2.99)	-2.04 (8.87)

Independent Variable	Total Sample	Chawama	Bauleni	Kaunda Square
Sample Size	139	74	32	33
R2 (adjusted)	0.73	0.64	0.33	0.34
F Statistic	24.33	10.24	2.19	2.20

Source: Equation (6) estimated with data from Home Improvement Survey (1979)

Note:
1. Standard errors of coefficients in parentheses
2. *Coefficient significantly different from zero at 95 percent confidence level.

TABLE 20

ESTIMATED HEDONIC PRICES

Variable	Hedonic Prices		
	Linear	Log-Exponential	Log-Linear
Floor Area of the Dwelling	-0.02	.004	-0.2
Age of the Dwelling	-0.15	-0.15	-0.10
Number of Rooms	0.78	0.94	1.04
Travel Time To Work	0.12	-0.09	-0.08
Area of the Lot	0.05	0.10	0.13

Calculated from tables 18 and 19 at the mean level.

IV. Footnotes

1. Republic of Zambia. Third National Development Plan 1979-83, National Commission for Development Planning. (Lusaka, October 1979). p.379.

2. United Nations, Economic Commission for Africa; Food and Agriculture Organization. Report of the UN/ECA/FAO Economic Development of Zambia. (Ndola, Zambia) p.122.

3. Hywell, Davies D. Lusaka: Some Town Planning Problems in an African Capital City at Independence. Zambia Urban Studies, No. 1. (Lusaka, University of Zambia, 1969) p. 5.

4. Mulford, John. Income Elasticity of Housing Demand. Housing Assistance Supply Experiment R-2449-HUD. (Santa Monica, California, Rand Corporation, July 1979).

5. Goodman, Allen C. Housing Submarkets Within Urban Areas: Definitions and Evidence. Working Papers in Economics No. 63. (Baltimore. The John Hopkins University. July 1980)

6. Quigley, John M. What Have We Learned About Urban Housing Markets In Current Issues In Urban Economics. Peter Mieszkowski and Mahlon Straszheim. eds. (Baltimore. The John Hopkins University Press, 1979) p. 396.

7. Goodman, Allen C. and Kawai, Mesahiro. Permanent Income, Hedonic Prices and Demand For Housing: New Evidence. Working Papers in Economics No. 61. (Baltimore, The John Hopkins University, June 1980)

8. Quigley, John M. What Have We Learned About Housing Market. (1979) p. 396.

9. Mulford, John. Income Elasticity of Housing Demand. (1979) p. 15.

10. Winger, A.R. "Housing and Income," Western Economic Journal, Vol. VI, No 3 (June 1968) p. 226.

11. Quigley, John M. What Have We Learned About Housing Markets (1979) p. 399.

12. Karanfilovic, Kirsten. Development Communication in an Urban Setting: The Lusaka Squatter Upgrading Project. (Development Communication Report No. 31, July 1980) p. 1.

13. National Housing Authority. Design Aspects of Low Cost Housing Projects, Third African Conference on Housing. (Lusaka. n-d.) p.7.

14. National Housing Authority. Design Aspects of Low Cost Housing Projects. p.9.

V. References

1. Goodman, Allen C. and Kawai, Mesahiro. Permanent Income, Hedonic Prices and Demand for Housing: New Evidence. Working Papers in Economics No. 61. (Baltimore, The John Hopkins University, June 1980)

2. Karanfilovic, Kirsten. Development Communication in an Urban Setting: The Lusaka Squatter Upgrading Project. (Development Communication Report No. 31. July 1980)

3. Goodman, Allen C. Housing Submarkets Within Urban Areas: Definitions and Evdience. Working Papers in Economics No. 63 (Baltimore. The John Hopkins University. July 1980)

4. Hywell, Davies D. Lusaka: Some Town Planning Problems in an African Capital City at Independence. Zambia Urban Studies No. 1. (Lusaka, University of Zambia, 1969)

5. Mulford, John. Income Elasticity of Housing Demand. Housing Assistance Supply Experiment R-2449-HUD (Santa Monica, California. Rand Corporation, July 1979)

6. Mieszkowski, Peter and Straszheim, Mahlon. eds. Current Issues in Urban Economics. (Baltimore, The John Hopkins University Press, 1979)

7. National Housing Authority. Design Aspects of Low Cost Housing Projects. Third African Conference on Housing (Lusaka, n.d.)

8. Winger, A.R. "Housing and Income" Western Economic Journal, Vol. VI, No. 3. (June 1968)