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BIASES IN TAX ASSESSMENT OF RESIDENTIAL PROPERTIES IN KARACHI

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This paper is a study of the residential property tax in Karachi. It studies differences between assessment values and market values of properties and investigates whether these differences in the two are random or systematic. Results indicate that there are significant biases in favour of higher quality, owner-occupied and independent houses which also make the tax regressive. In light of the findings suggestions are made for improvement in the present assessment formula.

I. Introduction

Extensive empirical literature is available on the subject of variations in effective property tax rates. Much of the discussion has concentrated on the incidence aspect and the degree of capitalization of the differentials in the rates [see Orr (1968) and Hyman and Pasour (1973)]. Some attention has also been paid to the equity aspects of the property tax and the measurement of assessment performance [see Berry and Bednarz (1975) and Paglin and Fogarty (1973)]. Basically such studies measure two types of inequities: (i) non price associated inequity, i.e., properties with the same market values assessed at different rates and (ii) systematic income related biases often termed as vertical administrative inequity. Paglin and Fogarty (1973) and Sabella (1973) in their works measure both types of inequities and also investigate whether they are augmented by a reappraisal lag (i.e., interval between date of assessment and date of sale of properties).[1]

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[1] Almost all the studies on the subject use the assessment/sale price ratio to measure assessment performance.

This paper is aimed at: (i) studying differences between market values and assessment values of residential properties in the city of Karachi, (ii) identifying whether these differences (biases) are random or systematic and (iii) suggesting improvement in the present assessment formula in the light of findings.

Comparatively fewer studies are available which are directly related to the above issues; those available are mostly for developed economies. Berry and Bednarz (1975) in their study for Chicago in U.S.A. conclude that variations in the assessment sale price ratio of properties are random and that in most cases the market values and assessment values move together. These results are contrary to our results for Karachi where it is found that in most cases the assessor and the market disagree and that these biases in assessments are in fact systematic. Black's study (1974) undertaken in the U.S.A. in the city of Boston also demonstrates that variations in the assessment market price ratio (effective rates) are not random and that the lowest effective rates tend to prevail in the better sections of the city characterized by high property values and family incomes. Paglin and Fogarty (1973) also find that low priced properties are somewhat over-assessed.[2]

II. The Residential Property Tax in Karachi

The property tax levied on residential properties in Karachi is based on their annual rental values. Properties are assessed by the Excise and Taxation Department in the following manner. All properties are classified spatially into several divisions and further into localities which are largely homogeneous in terms of socio-economic and neighbourhood characteristics. Each property within a locality is classified as being excellent, good, fair or poor on the basis of some rough estimate of its quality of construction.[3] Per room construction rate for different quality properties for each locality has already been specified earlier. Gross Annual Rental Value (GARV) for assessment of an individual property is determined as the number of rooms multiplied by the appropriate rate of construction.

Allowance is made at the rate of ten per cent per annum for depreciation to calculate Net Annual Rental Values (NARV). Tax is then levied at different rates on these assessment values of houses.

The last general assessment in Karachi dates back to 1968-69. Some revisions were made in the rate in 1972 and the property tax is levied at the following rates since then.

[2] No study is published on the subject for Pakistan and this paper is an attempt to examine the related issues.

[3] Quality of construction is determined by the type of roof, floor, wiring, and paint used.

NARV	Property Tax Rate (%)
Rs. 0 – 250	Exempted
Rs. 250 – 12000	20.0
Rs. 12000 – 20000	22.5
Rs. 20000 and above	25.0

Properties having NARV between Rs. 250 and Rs. 12,000 are taxed at a constant rate which itself suggests that the tax is only mildly progressive with respect to assessments. Under the present system only the number of rooms is taken into consideration and not the size of the rooms also. This may bias assessments in favour of larger properties. There is also no tax on space which is left open suggesting that larger independent houses are under assessed.

III. Sampling Techniques and Data Sources

All residential properties in Karachi are classified into twelve divisions by the Excise and Taxation Department of the provincial government of Sind for assessment purposes. Each division is then subdivided into four levels of localities, A, B, C, and D, on the basis of size and quality of construction. Four divisions were randomly selected for our purpose of sampling. Thirteen localities were further identified randomly from these divisions and finally a sample of 285 properties was randomly chosen. Individual houses were selected through the Taxation Department's property registers (PTI). These registers have addresses and detailed information on the size, number of rooms, location and NARVs.

Data was collected on the sample of properties through three main sources:

1) The properties were visited in 1979 by a team of the Applied Economics Research Centre, University of Karachi. Information was collected through a detailed questionnaire on the type of property, its size, quality of construction, neighbourhood characteristics, distance from main facilities e.g., post office, main road etc., and actual annual rental values. Information on variables like quality of construction was obtained through a careful visual inspection of the property by the interviewer. Size and locality variables were cross-checked with the information available with the Excise and Taxation Department.
2) Excise and Taxation Department provided information on the assessed NARVs. This was a key variable where some misreporting was suspected.

The values reported by the interviewee were again cross-checked with those of the Excise and Taxation Department.

3) Data on the age of the property was obtained from the Karachi Development Authority where all residential construction has to be registered for obtaining a building permit.

IV. Theoretical Framework for Econometric Analysis

A theoretical model was selected for identifying systematic divergence between assessment values and market rental values. Assessment of the NARVs can be represented in the following manner:

$$NARV = f(Q, L, O)\ TR \qquad (1)$$

where Q represents quality, L, locality, O, owner-occupied and TR, number of rooms.[4] TR is multiplicative in equation (1) because assessment is on per room basis. According to the assessment formula, total number of rooms not only includes bedrooms and other rooms but also other ancillary covered area of the house. Therefore,

$$TR = BR + OT + DD + \tfrac{1}{2}SR + \tfrac{1}{2}DR + \tfrac{1}{2}CV + \tfrac{1}{2}G \qquad (2)$$

where,

BR = number of bedrooms,
OT = number of other rooms,
DD = drawing/dining room,
SR = store room,
DR = dressing room,
CV = covered verandah or TV lounge,
G = garage.

Assuming a particular functional form in equation (1) we have,

$$NARV = K_o e^{Q\lambda}\ e^{L\alpha}\ e^{O\beta_o} \bullet TR \qquad (3)$$

Market values in the property market can be expected to be determined not only by factors like quality of construction, location and number of rooms as allowed for in the assessment formula but also on other characteristics like size of rooms, extent of open space and the type of property

[4] Owner-occupied variable is included in equation (1) because some self occupancy exemptions and rebates are provided by the Excise and Taxation Department.

i.e., whether it is a flat or an independent house. The age of the house is also relevant.[5] Therefore, market value (equal to rental values) can be specified as:

$$\text{MARKET RENTAL VALUE} = K_1 \, e^{Q\phi} \, e^{L\psi} \cdot TR^{\beta_1} \cdot \left(\frac{CA}{TR}\right)^{\beta_2} \cdot \left(\frac{PS}{CA}\right)^{\beta_3} \cdot e^{\beta_4 F} \cdot e^{\beta_5 R} \qquad (4)$$

where,

Q = quality,
L = locality,
TR = total number of rooms,
$\frac{CA}{TR}$ = covered area/total number of rooms, representing the average size per room,
$\frac{PS}{CA}$ = plot size/covered area, representing extent of open space,
F = dummy variable for flat, where flat = 1, independent house = 0,
R = age of the property.

Once we have identified factors determining Assessment and Market Values the next step is to explain divergence in the two values. As such, the Assessed Value/Market Value ratio (AMRATIO) is the dependent variable in our analysis. The reason for this choice is that the same factors influencing the numerator and denominator could largely cancel each other out leaving the remaining variables to explain the divergence, i.e., the biases in the assessment.[6]

[5] There is no predetermined theoretical functional form for equation (3). Log linear form is being used because a wide range of non-linearities can be captured. Quality, locality and owner-occupancy are considered to be shift parameters whereas total room is a scale parameter, therefore, the equation is specified in this particular way. There is also the added advantage in the log linear functional form that coefficients can be directly interpreted as elasticity measures. Elasticity is assumed to be constant along the whole function and does not vary with the level of the independent variable. Moreover, the log linear form gives better results in terms of higher t-statistics on all variables. Available literature shows that both log linear and linear forms are being used.

[6] Two kinds of biases may be present. First, initially at the time of assessment the AMRATIO may not be one but less and, second, there is a lag in appraisal of properties (last assessment of properties was in 1968-69. Market rental values have gone up since but assessments remain the same).

From equations (3) and (4),

$$\frac{A}{M} = \frac{K_o\, e^{Q\lambda} \cdot e^{L\alpha} \cdot e^{O\beta_o} \cdot TR}{K_1 e^{Q\phi} \cdot e^{L\psi} \cdot TR^{\beta_1} \cdot (\frac{CA}{TR})^{\beta_2} \cdot (\frac{PS}{CA})^{\beta_3} \cdot e^{\beta_4 F} \cdot e^{\beta_5 R}}$$

$$= \frac{K_o}{K_1}\, e^{Q(\lambda-\phi)} \cdot e^{L(\alpha-\psi)} \cdot e^{O\beta_o} \cdot TR^{(1-\beta_1)} \cdot (\frac{CA}{TR})^{-\beta_2} \cdot (\frac{PS}{CA})^{-\beta_3} \cdot e^{-\beta_4 F} \cdot e^{-\beta_5 R}$$

that is,

$$\log \frac{A}{M} = \log(\frac{K_o}{K_1}) + (\lambda-\phi)Q + (\alpha-\psi)L + \beta_o O + (1-\beta_1)\log TR - \beta_2 \log(\frac{CA}{TR}) - \beta_3 \log(\frac{PS}{CA}) - \beta_4 F - \beta_5 R \quad (5)$$

Statement of Hypothesis

1) $(\lambda - \phi)$ is ambiguous. A positive coefficient with $\lambda > \phi$ would mean that a larger proportion of the market value is taxed as the quality of the house improves. A negative coefficient with $\phi > \lambda$, would, however, show an underassessment of better quality properties.
2) $(\alpha - \psi)$ is ambiguous. A positive coefficient for the location variable with $\alpha > \psi$ would indicate that posh localities are paying more in property taxes as a proportion of their market values while a negative coefficient with $\psi > \alpha$ would mean that localities characterized by low incomes and property values are overassessed.
3) β_o is ambiguous. A positive β_o would mean that owner-occupied properties are over assessed as compared to rented ones. A negative coefficient would, however, mean a bias in favour of owner occupied properties.
4) $(1 - \beta_1)$ is ambiguous. Both the assessment authority and the market consider the number of rooms. If the increase in market value is pro-

portional to the number of rooms then $(1-\beta_1)$ should be zero. A negative $(1-\beta_1)$ would mean that market values rise disproportionately with the number of rooms. A positive coefficient, on the other hand, would indicate that market values rise less then proportionately with the number of rooms.

5) $\beta_2 > 0$. The market considers the size of a room also and properties with larger rooms have higher market values but since their assessment is unaffected their AMRATIO declines. The coefficient β_2 is, therefore, expected to be positive.
6) $\beta_3 > 0$. More open space adds to the market value of a house but its assessment remains same, therefore, AMRATIO goes down.
7) β_4 is ambiguous. The hypothesis that we test here is that for flats the AMRATIO is lower than for independent houses. A negative β_4, on the other hand, would mean an overassessment of flats.
8) $\beta_5 < 0$. This is consistent with the view that property values decline with age.[7]

The final model selected is represented by equation (5) and a detailed description of variables is given in Appendix 1.

V. Identification of Biases

Ideally an assessment formula should be such that assessments are at hundred per cent of market values and the AMRATIO is one. However, the average AMRATIO for the sample of residential properties in Karachi was 0.31 in 1979, well below one. The last general assessment of such properties dates back to 1968-69 and there has been substantial increase in market rental values upto 1979. This could largely explain the generally low value of AMRATIO.

Regression analysis is used to determine the direction and size of the differentials in assessed and market rental values. As mentioned earlier, we test for six different kinds of biases with respect to quality, owner/rented status, flat/independent house, location, size and age. The results of estimation of equation (5) are given in Table 1 and are discussed below.

[7] There are two components of β_5 coefficient. The first relates to the age of the property and is expected to be positive based on the hypothesis that the market depreciates properties faster than the assessor. The second component captures the effect of the year in which property was assessed and is expected to be negative based on the hypothesis that rate of assessment per room has changed over the years with the more recent assessments reflecting some increase in rental values. The year of assessment variable is entered as a Dummy taking the value one before 1971-72 and zero afterwards.

A) *Quality*

Empirical results indicate that the market not only values quality improvements at a higher rate but also in a more comprehensive manner. Three measures of quality, FS1, FS2, FS3, which are composite indices derived through factor analysis are included in the model. The indicators of quality included in each index are listed in Appendix 2 along with the results of the factor analysis.

Significant negative coefficients of −0.138 for FS1 and −0.033 for FS3 point to a considerable assessment bias in favour of higher quality properties. Appropriate adjustments are therefore required. An increase in assessment of thirteen per cent on all quality variables in FS1 and of four per cent on all those included in FS3 will remove the quality-wise bias and bring assessments in line with the market valuation of properties.

B) *Owner/Rented Status*

Under-assessment of owner-occupied properties created out of various exemptions and rebates provided to them is confirmed by the results. The OWNER variable has a significant negative coefficient of −0.275. Therefore, either the assessments on self occupancy will have to be raised by about twenty four per cent or that on rented properties be reduced by a corresponding percentage to remove the bias.

C) *Flat/Independent House*

There is no property tax levied on open spaces used for lawns, etc. As such our empirical results show that independent houses are under-assessed compared to flats (apartment houses) as a proportion of their market values. The significant positive coefficient of 0.414 for the flat dummy indicates that assessments for flats capture substantially higher proportion of their market values as compared to independent houses.

Given the extent of the bias currently, the assessment of independent houses should at least be at one and a half times the present rate or those on flats be lowered correspondingly to bring the two types of properties at the same level. The required degree of adjustment highlights a strong inequity in the tax structure under the present system.

D) *Size*

Three different variables are used to test for a bias with respect to size, viz., total number of rooms, room size, and open space. All three variables have positive signs with the number of rooms and room size varia-

TABLE 1

Regression results of logarithm of amratio

Independent Variables[a]	Regression Coefficients
OWNER	−0.275
	(−2.03)**
FLAT	0.414
	(2.14)**
LTR	0.373
	(2.05)**
LROOMSZ	0.435
	(3.08)***
LOPENSPC	0.249
	(1.48)
FS1	−0.138
	(−1.87)*
FS2	0.105
	(1.36)
FS3	−0.033
	(−1.96)**
LOC1	−0.435
	(−1.80)*
LOC2	−0.149
	(−0.82)
AGE	0.019
	(1.39)
DUMMY	−0.436
	(−2.14)**
CONSTANT	−3.386
DEGREES OF FREEDOM	188
$\bar{R}^2$	0.265
F	6.707

Figures in parentheses are t-ratios.

* Significant at the 90% level of significance.

** Significant at the 95% level of significance.

*** Significant at the 99% level of significance.

[a] Detailed description of the variables is given in Appendix 1.

ble highly significant showing that a larger proportion of market values is tapped in assessments of larger properties.[8]

E) *Locality-wise Bias*

All properties are classified into three localities (LOC1, and LOC2, LOC3, dummies) basically representing the three income groups, high, medium and low. LOC1 and LOC2 variables are included in the regression analysis while LOC3 having the smallest and lowest quality houses is treated as the excluded category. Both variables have negative coefficients with LOC1 variable (coefficient of −0.435) significant at the ninety per cent level indicating that as the market values in these localities rise their assessments lag behind as compared to localities with low property values and family incomes. This assessment bias in favour of the most posh localities is not only serious because assessments fail to keep pace with rising market rental values but also because they confirm the hypothesis that people living in the best localities have more access to and influence on the assessment machinery.

F) *Age Bias and Effect of the Year of Assessment*

The results show that the age variable has a positive coefficient of 0.019 indicating that the market depreciates properties faster than the assessor. The coefficient, however, is not significant. The assessment rates per room may have changed since last general assessment in 1968-69 to reflect some of the rise in market values. The assessment year dummy (taking value of one before 1971-72 and zero after) is included in the model. The variable has a significant negative coefficient of −0.436 and demonstrates that newer properties have higher AMRATIOS because they are assessed later. The variable thus does capture some of the inflationary effect of rising market rental values.

[8] All three variables may suffer from some measurement errors. The total room variable includes the whole inventory of the house irrespective of its size. For smaller houses the variable may be overestimated e.g., even very small store rooms, dressing rooms, T.V. lounges are treated as half rooms (see Appendix 1). Further, there is also the problem of each component, a bedroom, a T.V. lounge being identified. The distinction is not always properly made.
The covered area (built on) variable may also have introduced a measurement bias in two ways: (i) The law requires a maximum fixed proportion of plot size which can be built on. This proportion varies inversely with plot size e.g., for 2000 square yards plot 1/4 is allowed, for 1000 square yards plot 1/3 and for 600 square yards plot 2/3 is the maximum area which can be built on. The reported covered area, therefore, may not always be the actual area under construction but that required by law; (ii) the covered area is also not easily measurable for units which are actually a part of a larger house but have been partitioned into separate independent dwellings. Our sample sometimes just included one of these units.

VI. Conclusions

The present assessment formula used by the Excise and Taxation Department in Karachi has substantial scope for improvement. There is a marked under-assessment due to under coverage of rents at time of original assessment and due to the general inflation in rental values. A broader and more frequent assessment system with more progressive tax rates are plausible solutions to the problem.

A detailed look at assessments in relation to market values also clearly shows that there are significant biases in favour of higher quality owner-occupied and independent houses which tend to make the present property tax system regressive.

The property tax liability, T, as a proportion of income can be defined as:

$$\frac{T}{Y} = t \bullet \left(\frac{A}{M}\right) \bullet \left(\frac{M}{Y}\right)$$

where t is the property tax rate and Y represents income. A look at assessment and market values in Karachi clearly indicates that t rises gradually with A. Market rental value as a proportion of income, M/Y also rises slowly with income.[9] The results above, however, demonstrate that assessed to market value ratio, A/M, falls substantially for higher priced properties. The last factor is responsible for tending to make the property tax in Karachi regressive given the prevailing assessment practices. This strongly underscores the need for reform of the methodology used for determining the GARVs.

Either the assessment for underassessed properties be raised substantially or those on other properties be reduced to remove these inequities. Once a broader assessment formula has been devised to bring assessment values more in line with the market values of properties the tax rates can be made more progressive to make the tax more equitable.

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[9] Muth (1960) demonstrates that rental values are a constant proportion of permanent income. The Household Income and Expenditure Survey for Pakistan, 1979, shows that rental values as a proportion of income rise very slowly with income.

APPENDIX 1

TYPE OF PROPERTY

OWNER	Dummy for owner-occupied: Owner-occupied = one, Rented = zero.
FLAT	Dummy for flat: Flat = one, Independent house = zero.

SIZE VARIABLES

PLOTSIZE	Area of the property lot in sq. ft.
CDAREA	Built-up area in sq. ft.
BEDROOM	Number of bedrooms.
OTHROOM	Number of other rooms.
BATHROOM	Number of bath rooms.
GARAGE	Dummy variable indicating presence of garage.
SRVQTS	Number of servant quarters.
TR	Total number of rooms.
ROOMSZ	CDAREA/TR
OPENSPC	PLOTSIZE/CDAREA

QUALITY INDICATORS

IMPFIT	Dummy variable indicating presence of imported electrical fittings.
TILE	Dummy variable indicating presence of tiled floor.
MOSSAIC	Dummy variable indicating presence of mosaic flooring.
WIRCON	Dummy variable indicating presence of concealed electrical wiring.
TEAK	dummy variable indicating presence of teak doors.
IRON	Dummy variable indicating presence of iron windows.
DISTMPR	Dummy variable indicating presence of distempered walls.
OILBND	Dummy variable indicating presence of oil bounded walls.
PLSEM	Dummy variable indicating presence of plastic emulsion painted walls.
SANTILE	Dummy variable indicating presence of tiles in bathrooms.
BATHTUB	Number of bathtubs.
SANMOSS	Dummy variable indicating presence of mosaic bathroom floor.

SANFIT	Dummy variable indicating presence of imported sanitary fittings.
KITCAB	Dummy variable indicating presence of kitchen cabinets.
EXFAN	Number of exhaust fans in kitchen.
KITTILE	Dummy variable indicating presence of tiled kitchen floor.
KITMOSS	Dummy variable indicating presence of mosaic kitchen floor.
SINKIMP	Dummy variable indicating presence of imported sink.
GEYSER	Dummy variable indicating presence of geyser.
FLYROOF	Dummy variable indicating presence of full fly proofing.
CORPLOT	Dummy variable indicating a corner plot.
WESTOPEN	Dummy variable indicating a west open house.

A G E

YEAR	Age of the house.
DUMMY	Year of assessment dummy variable: one before 1971-72 and zero after.

LOCALITY

LOC1	Dummy variable for high income localities.
LOC2	Dummy variable for middle income localities.

APPENDIX 2

Factor Analysis of Quality Indicators

It is widely believed that both the market and the assessor consider residential quality in terms of some broad aggregates. This study includes twenty-two quality measures of the dwelling unit. Factor analysis is used for aggregating and constructing composite quality indices. Varimax rotation is used in the analysis and the number of factors is constrained to three to facilitate interpretation. The three factor solution summarized in Table A.1 accounts for 77 per cent of the variation in the 22 variables*.

* The first factor accounts for 40.85 per cent of the total variance of the original variation matrix and loads heavily on 13 variables. The second factor accounts for an additional 24.88 per cent of the variation and 6 variables load on it. The third factor accounts for 18.48 per cent of the variation and only 3 variables load on it.

Composite indices were constructed each representing a factor as follows:

$$FS_{ik} = \sum_{i=1}^{22} F_{jk} Z_{ij}$$

where Z_{ij} represents the standardized value of each variable [Z_i = (Variable − Mean/Standard Deviation)] with subscript i for properties ranging from 1 to 200, and subscript j for variables ranging from 1 to 22. FS_{jk} represent factor scores where k extends from 1 to 3 for the three factors.

The three composite indices derived were used as variables in the regression analysis as measures of quality of the house.

TABLE A. 1.

Factor analysis results

Variables	Factor 1	Factor 2	Factor 3	Communality
BATHTUB	0.757	0.007	0.131	0.590
SANTILE	0.732	–0.053	0.212	0.583
FLYPROOF	0.656	0.142	0.242	0.509
GEYSER	0.624	0.175	0.064	0.424
KITTILE	0.558	–0.163	–0.303	0.429
TEAK	0.538	0.095	0.263	0.367
KITCAB	0.513	0.166	0.140	0.310
SANFIT	0.483	0.055	0.045	0.238
IMPFIT	0.482	0.032	0.113	0.246
EXFAN	0.481	–0.024	0.038	0.233
TILE	0.390	–0.225	–0.400	0.363
OILBND	0.197	–0.047	0.119	0.055
IRON	0.173	0.106	–0.190	0.078
KITMOSS	0.051	0.803	0.277	0.724
MOSSAIC	0.282	0.797	0.102	0.725
SANMOSS	–0.297	0.752	–0.196	0.692
SINKIMP	0.004	0.521	–0.310	0.368
WIRCON	0.345	0.460	0.229	0.383
DISTMPR	–0.248	0.208	–0.709	0.608
PLSEM	0.339	0.130	0.672	0.583
WESTOPEN	0.156	0.055	0.358	0.156
CORPLOT	0.141	0.043	0.149	0.044
EIGEN VALUES	4.220	2.570	1.910	
Percentage of Variation explaine:	40.85	24.88	18.48	

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