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HOUSEHOLDS AND HOUSING: RESIDENTIAL MOBILITY,  
TENURE CHOICE, AND SPACE CONSUMPTION  
IN THE DEVELOPING METROPOLIS

by

Andrew Marshall Hamer

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Urban and Regional Economics Division  
Development Economics Department  
Development Policy Staff  
The World Bank  
Washington, D.C.

## ABSTRACT

### Households and Housing: Residential Mobility, Tenure Choice, and Space Consumption in the Developing Metropolis

Bogota and Cali are cities of considerable size populated by households which, in the main, have fairly high incomes by the standards of the developing world. The household heads tend to be relatively young, overwhelmingly male, and migrants by birth. The latter fact does not seem to be associated with widespread "marginalization". The households typically include 5 members and that size is declining over time. They live in low density environments, and roughly half own their dwellings.

Residences are more concentrated in particular macro-zones than jobs and in neither case is there a pronounced tendency to live or work near the core. Using various measures, one can identify particular areas of each city which are "affluent" or "disadvantaged".

The data reviewed uncovered significant and similar rates of residential relocation over time in both cities. Roughly 23 percent of all households moved within the year prior to the surveys. The one longitudinal study examined suggests that hypermobility is confined to only a small fraction of households. Mobility is held down by rising income, the aging of the household head, and increasing household size. Also depressing mobility are those factors which point to "settled" behavior, such as a lengthy prior tenure and a long commitment to the present job by the household head. Independent of other characteristics, household heads with a recent history of residence in the city are likely to have higher mobility rates than their counterparts.

When patterns of relocation are examined by concentric ring, decentralization appears to be slowing down in Bogota and is fairly modest in Cali. Reverse migration, from farther out to closer rings is rare. Furthermore most moves take place within the ring of origin.

The rings are very different in size, and so heterogeneous in their resident household income characteristics that it proves difficult to examine the validity of hypotheses that individuals living in certain zones are "locationally disadvantaged" and face barriers in attempts to move in search of greater opportunities. Using more homogeneous radial sectors as units of observation suggests that a strong pattern of upper-income self-segregation is at work in Cali and Bogota. It is, however, true that sectors characterized as lower income in character do have higher "retention" rates when only one move is considered. An attempt was made to model the determinants of move distances.

While city-specific factors play an important role, in both cities an increased length of tenure in the prior residences increases distance moved. Households living in higher density environments tend to move shorter distances; only in Cali, however, is there evidence that

prior residence in a "disadvantaged" sector has a negative impact on distance moved. Other variables also prove significant in only one or the other city.

Though some variables of interest are not available (such as relative prices), it is possible to model the tenure choice behavior of owners and renters. The probability of ownership is enhanced by rising household income, the aging of the household head, growing household size and the two indices of household "stability". Other variables such as the number of workers contributing to the household incomes, the recent arrival of the household head to the city, and a location in a lower-income sector prior to the most recent move, all tend to reduce the probability that the household will own. The coefficients obtained in the multivariate estimations have similar values but opposite signs from those found in the mobility equations, suggesting that factors which are associated with greater mobility depress homeownership and vice versa.

Owners occupy more space than renters, whether viewed as a whole or within categories like "low income". Low-income households are smaller in size than the average for each over-all category, and their space utilization is also smaller. Among owners, space consumption is enhanced by household income and household size. The need to rely on self-help housing methods, to depend on secondary workers, and to house tenants, tends to depress consumption. There is evidence of an independent "sector of origin" effect. The magnitude of these effects is similar in Bogota and Cali. Among renters, space consumption is enhanced by the self-same variables cited in the homeowners case, plus the age of the household head and a history of recent migration into the city. Among the continuous variables tested, there is a broad similarity in elasticities obtained at the mean between owners and renters; one clear exception is the far larger family size effect found among renter households. Origination in a disadvantaged sector depresses space consumption among renters and does so far more than among owners. As expected, pooling the data for owners and renters confirms the role of income, household size, and ownership in boosting space use. Factors such as the reliance on tenants and secondary workers, and previous residence in a disadvantaged sector, all depress space utilization.

## SECTION I: AN INTRODUCTION

### The Issues

There are many reasons for wanting to undertake a detailed analysis of household behavior in making choices related to residential behavior. Those who influence household behavior through public sector investments, taxation policies, and regulatory practices must determine, at a minimum, whether behavior in this area is random or whether, instead, it follows certain predictable patterns which might be taken into account.

More specifically the degree and nature of residential mobility is important to anyone concerned with changes in the spatial patterns of location in a rapidly growing metropolis. Do households change residences rapidly over time? Are there certain variables that help identify the degree to which households change residences? Are these movements scattered across the urban landscape or do they cluster within well-defined perimeters? If households do cluster their moves why do they do so? Can such a phenomenon be reconciled with a process of outward movement of jobs and residences over time? Finally, can such a phenomenon be reconciled with the freedom to move laterally, across radial sectors, or are these urban areas mired in a process of ghettoization, where certain sectors act as "black holes", effectively barring its residents from taking advantage of opportunities elsewhere?

The answers to these questions could help clarify the likely effectiveness of policies such as the promotion of transportation investments focused radially upon the traditional center versus those targeted at the promotion of lateral movement in the periphery. Alternatively the location of publicly subsidized housing schemes could be a critical ingredient to their success; there may well be reasons why the organized removal of low income households from certain locations to others are more or less successful.

Policy makers often treat shelter as a "basic need" whose provision must be shaped by direct or indirect intervention in the housing market. They must decide whether or not to provide public housing. They must consider whether or not these facilities are to be owned by a government authority overseeing tenants or by the occupants themselves. They must choose whether or not to construct owner-occupant structures in such a way that they are modifiable over time and open to multiple uses. There are, to name three examples, very different implications to building finished high-rise apartments, providing a single-story shell which can be expanded, and subsidizing nothing but the acquisition of building materials and basic public services. To each one of these concerns the driving forces behind tenancy choice and space consumption are crucial.

There are other important issues, as well, upon which tenure and space consumption determinants have a bearing. Governments may regulate land use or financial institutions in ways that have very profound impacts on the shelter options of the poorer households. Would a restructuring

of residential subdivision standards or of mortgage institutions be more likely to achieve "basic shelter" objectives than existing institutional arrangements permit? Such questions are crucial to any effective public policy in this field.

There are many ways to tackle issues of the type taken up here. The one used is to probe individual household behavior through the use of several surveys undertaken in Colombia. These micro-level data sets are examined in often painstaking fashion to develop models of behavior from which, ultimately, policy-relevant conclusions may be derived.

#### The Data Base

The Bogota Urban Development Study Phase II was undertaken to establish a 1980 plan for the metropolis, dealing with urban infrastructure investment, land use controls, taxation policies and administrative reorganization. The study began in August 1972 and concluded in March 1974. In 1972, a household survey was undertaken, using questionnaires designed to produce detailed information on household characteristics, including those related to housing conditions and the location of household residences and the workplace of labor force participants. The survey was based on a sample of 4,675 households, representing the most complete data collection effort following the Census of 1964.

In terms of detail, the Phase II household survey is comparable only to the 1978 survey performed by the national census bureau, the Departamento Administrativo Nacional de Estadistica, in conjunction with the World Bank. The 1978 study was conducted in Bogota and Cali among 3066 and 983 households, respectively. Like the 1972 study it contained

very detailed questions on the residence and work place of the members of households in the labor force. This was supplemented by information on dwelling and structure characteristics, and relevant demographic and socio-economic data, paralleling, once again, the Phase II survey.

Some use was also made of a retrospective history of 730 adults 20 to 45 years of age living in Bogota. This was derived from a survey conducted in 1975 by Robert Corno. The choice of the 20 to 45 age group was meant to focus attention on a large number of migrants. As in the other two surveys, the Corno study was based on a detailed sampling frame (drawn from Phase II, uncorrected for changes through 1975) on the basis of which the responses were "expanded" to represent the population of the city as a whole in the relevant age category. The most valuable data collected during this survey were the longitudinal records of the origin and destination of residential moves made by adults throughout their life in Bogota.

#### A General Profile of Households

Any explanation of residential behavior in Bogota and Cali can begin profitably with a brief introduction to the conditions in those cities at the time of the surveys.

In 1972, Bogota recorded approximately 503,000 households averaging 5.7 persons in size, for a total population of 2,850,000.<sup>1/</sup>

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<sup>1/</sup> Household responses vary according to the different sets of questions asked. Therefore totals in tables presented below may not correspond to the cited numbers. The 1973 Census reports a total of 495,259 households, averaging 5.2 persons in size, and a total population of 2,571,548. The reasons for the discrepancy have not yet been explored. See XIV Censo Nacional de Poblacion y III de Vivienda (Octubre 24 de 1973), Bogota, D.E., Bogota, Departamento Administrativo Nacional de Estadistica, September 1980, p. 29.

By 1978, the total household count had risen to roughly 722,000, averaging a lower 4.8 persons per unit, for a population of 3,439,000.

Cali, by contrast, is a smaller city, with 219,000 households in 1978, averaging 4.8 persons in size, for a population of 1,055,000.<sup>2/</sup>

Being only 30% the size of the population of Bogota, Cali provides the basis for interesting cross-sectional tests of relationships uncovered in the capital area.

For purposes of descriptive analysis, many household variables were aggregated into more manageable categories. One of these was the distribution of income. An attempt was made to define a group of poverty households, proxied by a reported income level (labor plus non-labor income<sup>3/</sup>) equal to one-half the median for the city as a whole. An intermediate income category was defined by the interval between the poverty level and the median, and a final category of "better off" households was allocated to the above-median income group. Because 1972 income was itself reported in interval form, the median had to be estimated using a piecewise Pareto approximation procedure.<sup>4/</sup> That yielded a median income of 1731 pesos

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2/ The 1973 Census reports 175,000 households, averaging 5.2 persons in size, for a total population of 918,057. See XIV Censo Nacional de Poblacion y III de Vivienda, Octubre 24 de 1973: Departamento del Valle, Bogota, Departamento Administrativo Nacional de Estadistica, December 1980, p. 63.

3/ A decision was made to omit the imputed income from homeownership in the discussion that follows.

4/ Alvaro Pachon, Urban Structure, Modal Choice, and Auto Ownership in Bogota, 1972, Washington, D.C., World Bank City Study Intermediate Paper No. 31, June 1979, Table 3.

per month. For the sake of simplicity, in this study the level of 2000 pesos per month was used as a proxy for the median, with 1000 pesos per month defining the cut-off below which households were labelled as poor. No effort was made to create a more elaborate set of definitions, where total, adult, or adult-equivalent household size would be considered in allocating a unit to one or another of the intervals defining the poor, the intermediate-income households and the higher-income households.

For 1978, where household income data was reported in absolute terms, the Bogota median was set at 8000 pesos per month, and the poverty cut-off at 4000 pesos per month. In Cali, the levels proved to be lower: the median totalled 7016 pesos per month (rounded off to 7000 pesos) and the poverty level was defined as 3500 pesos per month. Since the cost of living in both cities was approximately the same in 1978, these nominal differences probably represent real differences as well. <sup>5/</sup>

It is difficult to translate these units into a standard easily identifiable by those unfamiliar with Colombia. Since the dollar is one

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5/ This conclusion was originally based on an updated version, by Alvaro Pachon, of work carried out in 1969 by Alberto Hernandez Garcia ("Comparaciones de Precios y Costo de Vida en Cuatro Ciudades Colombianas", Bogota, Universidad de los Andes, Economics Department, Masters Thesis). Hernandez used city-specific market baskets derived from a 1968 survey, bypassing the Census Bureau's outdated 1953 market basket, which remained in use until the late 1970s. The original work suggested Cali's market basket cost only 92% that of Bogota's. The update, using 1978 prices suggests an elimination of any differential. This finds corroboration in the recent work of the Census Bureau. It now uses bundles of goods and services based on 1971 consumption surveys, providing estimates for blue collar and for white collar workers. Taking Bogota values as a base, the December 1978 Cali index for white collar workers is equal to .89 and for blue collar workers is equal to 1.01. (Data supplied by the Census Bureau). An assumption of rough parity therefore seems reasonable.

standard unit of comparison, the above cited levels can be converted in dollars of the year in question using purchasing power parity rates rather than foreign exchange rates. The former take into consideration those goods and services that do not enter into international trade, the so-called non-traded goods. The 1972 dollar totals were inflated to 1978 dollar equivalents by simply applying the conversion factor suggested by the U.S. consumer price index. <sup>6/</sup>

The results, which are merely indicative given the manipulations involved, suggest that a poverty level of 1000 pesos per month in 1972 translates into an annual income of 2124 dollars (1978), while the proxied median was twice that, or 4248 dollars. For 1978, the poverty level for Bogota was equivalent to 3000 dollars per year, and the median, to 6000 dollars per year. In Cali, the equivalent levels for the poverty cut-off and the median translated into 2628 dollars and 5256 dollars, respectively.

The high implicit growth in dollar incomes for Bogota between 1972 and 1978 is an artifact of differences in income coverage. Based on

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6/ Following I. Kravis, A. Heston, R. Summers, International Comparisons of Real Product and Purchasing Power, Baltimore, Johns Hopkins University Press, 1978, the average foreign exchange rate prevailing in 1972 and 1978 was adjusted downward to reflect the purchasing power parity rate, which stood at approximately 40% (pesos per dollar) of the former in the two years (1970, 1973) for which Kravis, et al made detailed comparisons (1970, 1973). The rates used were thus 8.8 pesos per dollar for 1972 and 16 pesos per dollar for 1978. The U.S. consumer price index, on an average annual basis, was 56% higher in 1978 than 1972 (see U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1979 (100th Edition), Washington D.C., 1979). Thus the Colombian data for 1972, once converted to 1972 dollar equivalent, was inflated by 1.56 to reflect a common 1978 dollar base.

estimates of total personal income derived from regional income accounts, for example, the 1972 survey accounts for 67% of the actual personal income in Bogota, while the 1978 survey covers 92% of the relevant total. <sup>7/</sup>

The poverty households, as defined, account for between one-fifth and one-quarter of all units in the surveys. As already noted, care should be taken in interpreting these figures, which include only reported labor and non-labor income and which provide for no adjustment by household size.

Turning to other indicators, one finds that between one-quarter and one-fifth of the households in the surveys were headed by young individuals who were 30 years of age or less. Another quarter to three-tenths was concentrated in the age grouping, 31-40, while the remaining half were over 40 years of age. These households were headed by males in the overwhelming majority of cases, though the percentage of female-headed households, appears on the rise for Bogota, increasing from below to above one-fifth, and is above one-quarter in Cali.

There is a tendency for household size to decrease over time. The data suggest fairly dramatic changes in Bogota, especially for small

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<sup>7/</sup> See A. Pachon, Urban Structure ...., op. cit., Chapter 2, and R. Mohan, The Determinants of Labor Earnings in Developing Metropoli: Estimates from Bogota and Cali, Colombia, Washington D.C., Urban and Regional Report No. 80-14, The World Bank, November 1980, p. 119.

(1-3 persons) and large households (7 or more persons). Large families fell from one-third to one-fifth of the total over the period, while small ones increased their share in mirror-image fashion. Cali, though a smaller city, parallels Bogota in 1978 in the distribution of household size. In all 3 cases, the bulk of households, with 45% to 50% of the total, include 4 to 6 members. These trends could have two components: declining birth rates and reduction in the number of relatives and friends sharing meals with a nuclear family, thus qualifying as household members in these surveys. 8/

Bogota and Cali are cities with a large number of migrants, defined as non-natives by birth. Fully three-quarters of the household heads are non-native in these cities, and approximately 12-13% are relatively young household heads who arrived in Bogota over the 5 years preceding the survey year. This heavy representation of non-natives among household heads is not matched to the same extent for the population at large. Apparently migrants arrive in these cities at an early enough age so that substantial numbers of their off-spring are native born. Thus, while three-quarters of the households heads are migrants, somewhat less than one-half of the population of Bogota is non-native; in Cali migrants form a bare majority of the population.

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8/ One study of total fertility rates (children ever born per female) in urban Colombia suggests that between 1973 and 1978 the rate fell by 19% from 3.6 to 2.9 children. See Nancy Birdsall, "Colombia: Declining Fertility and Human Welfare," Washington, Population and Human Resources Division, Development Economics Department, World Bank, 1979, p. 15. Similar conclusions for Colombia are reached in S. Quick, Country Demographic Profiles: Colombia, Washington D.C., Bureau of the Census, U.S. Department of Commerce, October 1979, Table A-8. Note should again be taken of the discrepancies uncovered earlier between Phase II and the 1973 Census.

Nor is the heavy influx of migrants a source of "marginalization" for vast sections of these cities' populations. Native households and non-native households have roughly similar income profiles, and it is only among the relatively young households of the "recent arrivals" <sup>9/</sup> that the weight of poverty is noticeably higher than among the native households. Since age and income are linked by such factors as education and experience, <sup>10/</sup> this disadvantage among recent migrant households is apparently temporary, for it hardly looms in the comparison of household income between units headed by natives and those headed by all non-natives, (I-1). Thus among 1972 Bogotanos native and migrant households (the latter of which include a recent migrant component equal to approximately 16%), poverty units equal just under one-fifth and one-quarter of their respective group; for recent migrants the poverty households account for over 30% of the total. In the intermediate income categories, all three types of households are represented by roughly one-third of their total number. The native households maintain an advantage over migrant households in the above-median income category (48% to 41%), with recent migrants having the smallest proportion, at 36%.

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9/ Roughly 40% of those household heads who arrived in the previous 5 years are under 30 years of age, a rate twice that for all households.

10/ Data from all three surveys suggest that the percentage of households earning less than the poverty level standard falls dramatically for households headed by individuals past the age of 30. This prevails until the household head reaches the age of retirement, when the proportion of households in poverty rises to levels approaching or surpassing that of the youngest households. See also R. Mohan, The People of Bogota: Who They Are, What They Earn, Where They Live, Washington, D.C., World Bank Staff Working Paper No. 390, May 1980, pp. 82-91, and especially Table 6.12.

Table I-1

Monthly Income Comparisons Between Households with  
Native, Migrant, and Recent Migrant Heads

A. Bogota, 1972

Income Category	Household Head Status	Native	Migrant	Migrant, Arrived 1967-1972
1000 pesos or less		18%	25%	31%
1001 - 2000 pesos		33%	34%	34%
Over 2000 pesos		48%	41%	36%

B. Bogota, 1978

Income Category	Household Head Status	Native	Migrant	Migrant, Arrived Within Last Five Years
4000 pesos or less		20%	25%	27%
4001 - 8000 pesos		23%	27%	31%
Over 8000 pesos		54%	48%	41%

C. Cali, 1978

Income Category	Household Head Status	Native	Migrant	Migrant, Arrived Within Last Five Years
3500 pesos or less		18%	20%	29%
3501 - 7000 pesos		27%	29%	29%
Over 7000 pesos		56%	50%	41%

In 1978, the gap in the proportions of each Bogota household group falling into the below-poverty category is narrower (20%, 25%, 27%, respectively), and the equiproportional representation of each group in the intermediate category no longer prevails. But the key finding is, as before, that migrant households as a whole have income profiles not very dissimilar from that of native households, in spite of the "drag" imposed by recent arrivals. Furthermore, as in 1972, substantial proportions of the households headed by recent migrants are found in the above-median income category. 11/

The evidence from Cali is broadly consistent with the information already presented for Bogota. Among the poorest income categories (up to 3500 pesos), the differences between native and migrant households, taken as a whole, is negligible, slightly favoring the native population. Recent migrants, almost two-fifths of whose heads are under 30 years of age, are more heavily represented in this category. Roughly three-tenths of all such households are classified as poor as opposed to one-fifth of the other two groups. Paralleling the 1972 Bogota results, all three types of households are found in the intermediate income category in roughly equal proportions. In the better-off category the difference between natives and

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11/ R. Mohan, in his study, The People of Bogota ...., op. cit., pp. 77-80, reports on data from the 1973 Census and the 1977 Household Survey which suggest in broad terms, that recent migrant workers earn less than long-term migrants and that migrants who have been in Bogota for many years earn more than native-born workers. The conclusions make no reference to household income.

all migrants is again small, with both groups represented by approximately half of their households. Recent migrants trail, with only about two-fifths of their numbers in this category.

Whatever one's prior expectations, these are cities where homeownership plays a major role. Roughly half of the households are homeowners and the remaining half rent or otherwise occupy premises as usufructuaries (Table I-2). These households opt for a relatively low density environment, showing a strong preference for single and two household buildings. These account for about three-quarters of all units in Bogota in 1972, and 90% of the units in 1978. In Cali these types of buildings account for 92% of the housing stock. The building data is reinforced by the information of dwelling types. In all three cases, independent houses prevail over all other options, representing 62% of the household choices in 1972 Bogota and over 80% of the choices in Bogota and Cali in 1978 (Table I-3).

Some of the shifts between the 1972 and 1978 Bogota totals are the result of differences in the administration of the surveys and may not represent true shifts in the direction of independent houses and their corresponding building types. A comparison of the 1972 and 1978 survey instruments, for example, points to the removal of the building type "rooming house" (inquilinato) in the latter survey. One assumes that these types of units, barring their unlikely disappearance (they represented 11% of the building types occupied in 1972) were redefined so as to fit other categories. It is

Table I-2

Present Tenure Choice of all Households

A. Bogota, 1972

	<u>Count</u>	<u>%</u>
Own	260,719	52
Rent	225,922	45
Other	16,160	5
Total	502,801	100.0

B. Bogota, 1978

	<u>Count</u>	<u>%</u>
Own	330,543	46
Rent	339,587	48
Other	41,862	6
Total	711,992	100.0

C. Cali, 1978

	<u>Count</u>	<u>%</u>
Own	110,105	51
Rent	94,171	43
Other	13,792	6
Total	218,068	100.0

Table I-3

A. BOGOTA, 1972

Type of Dwelling Compared with Type of Building

<del>Building Type</del>  <del>Dwelling Type</del>	Single Family	Two Family	Multi- Family	Rooming House	Total	
Independent House	84	17	4	1	100	%ROW
	100	32	14	7	62	%COL
Apartment or Floor	0	58	37	5	100	%ROW
	0	43	41	8	17	%COL
Room (s)	0	26	31	43	100	%ROW
	0	25	44	85	21	%COL
Total	52	22	15	11	100	%ROW
	100	100	100	100	100	%COL

Table I-3  
B. BOGOTA, 1978

Table I-3

C. CALI, 1978

### Type of Dwelling Compared with Type of Building

Dwelling Type \ Building Type	Apart-ment	Detached House	Attached House	Bi-Family House	Casalote	House Under Construction	Tugurio	Total	%ROW
									%COL
Apartment	69	13	1	17	0	0	0	100	%ROW
	97	2	1	28	0	0	0	11	
House	0	65	24	5	1	5	0	100	%ROW
	3	91	94	60	39	100	0	81	
Room(s)	0	67	19	14	0	0	0	100	%ROW
	0	6	5	12	0	0	0	5	
House of Scrap	0	0	0	0	35	0	65	100	%ROW
	0	0	0	0	6	0	77	2	
Other	0	0	0	0	0	0	100	100	%ROW
	0	0	0	0	0	0	23	0	
Total	8	58.15	20.93	6.39	1.30	3.83	1.87	100	%ROW
	100	100	100	100	100	100	100	100	

a matter of conjecture whether all were relabelled "apartments". In addition, the 1978 survey was administered by individuals who were paid a daily wage, regardless of the number of households interviewed, rather than a piece-rate. This differs from the per interview payment system used in 1972, which was abandoned for the 1978 study because of the extraordinarily detailed nature of that survey, especially the time-consuming collection of information on all household workers. Since interviewers in 1978 were supposed to survey all households in any given building entered, their work load was diminished to the extent that they avoided a complete inventory of households in the multi-family buildings encountered in the blocks to which they were assigned on any given day. Supervisors had no easy way to detect this behavior. This created an unknown downward bias in the count of households living in high density structures. It is, otherwise, hard to explain why, in Bogota, a six-year period would reveal a decline in the proportion of households living in multi-family buildings (including rooming houses), from 26% to 10%. There is a corresponding shift in dwelling types, particularly in the category of "rooms". In 1972, one-quarter of the households lived in "rooms", with approximately three-quarters of these being located in multi-family or rooming houses. By 1978, the recorded proportion of households living in "rooms" fell to 5%, and virtually all of these were located in houses (93%) not multi-family structures. Even allowing for the impact of rising incomes over the period in question, the suspicion remains that the 1978 data are flawed in this one respect.

### A Profile of Areas by Rings and Sectors

Figures I-1 and I-2 depict a zonal system for Bogota and Cali, respectively. These zones are labelled as either rings or sectors. The rings radiate from the core (Ring 1 and Sector 1), which represents the historic center of each city. The sectors are radial development corridors. <sup>12/</sup>

The population of each city shows strong preferences for particular rings and sectors. Among Bogota households reporting residence location, Ring 4 and Ring 5 together account for roughly 70% of the choices in 1972 and 1978. Similarly, Sectors 2, 3, and 6 contain roughly 60% of the household population in both years. In Cali such concentrations are also noticed. Ring 3 alone contains 43% of the household population while Sector 5 has almost 40% of the households. (See Table I-4).

Setting aside Ring 1 (Sector 1) in both cities, where the resident households are relatively and absolutely few in number, <sup>13/</sup> it is interesting

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<sup>12/</sup> The system of sectors had previously been developed by the Colombian Census Bureau (Departamento Administrativo Nacional de Estadistica), and was adapted to the purposes of the City Study. In Bogota, Sector 1 represents the historic core, Sector 8 represents the corridor of development for better-off households, dating back to the turn of the century. Sectors 4 and 5 are the primary corridors of industrial development that dissect lower income residential corridors to the south (2,3) and more heterogeneous corridors to the north (6,7). In Cali, a similar rationale prevailed. Aside from Sector 1, (the core), there are historically better-off sectors (2,7) and a set of industrial and working class areas (3,4,5). One sector (6) is a developing residential corridor with a mix of income groups.

<sup>13/</sup> Serious reservations need to be registered about data collected for Ring 1, Sector 1 in 1972. The household population is less than 2% of Bogota's total, rising to 3% by 1978. The 1973 Census suggests a proportion of 3.5% and an absolute number of households (18,192) which is over twice that reported in Phase II (R. Mohan, The People of Bogota..., op cit, pp. 52 and 127). A comparison of population data from 1973 and 1977 suggests that between those years population fell and household size rose (R. Mohan, ibid p. 133), implying, automatically, a decline in the number of households over that time period.

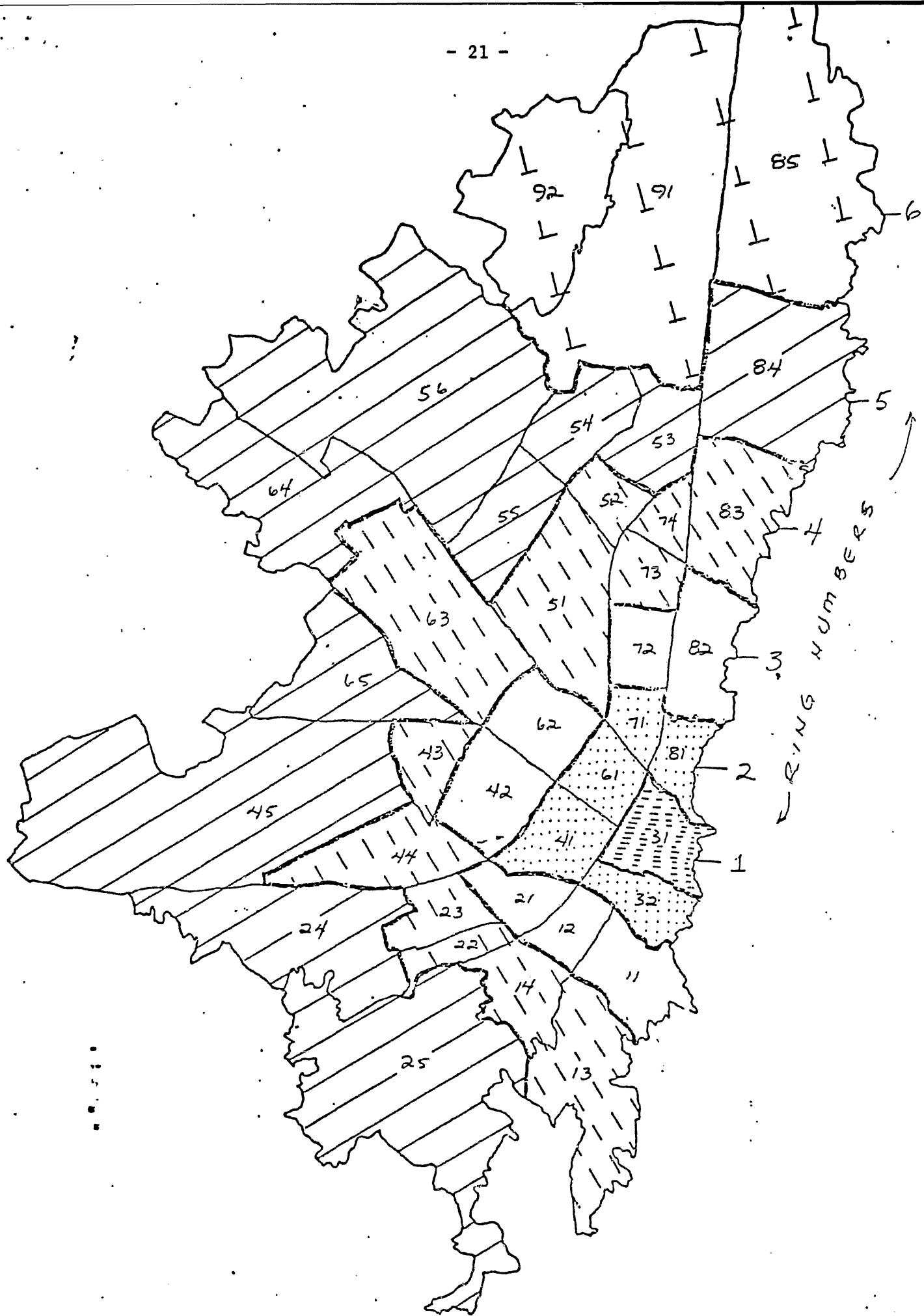
Figure I

BOGOTA: Ring System Based on 1973 Comunas

<u>RINGS</u>	<u>COMUNAS</u>
1	31
2	81, 71, 61, 41, 32
3	82, 72, 62, 42 21, 12, 11
4	83, 74, 73, 63, 52, 51, 43, 44, 23, 22, 14, 13
5	84, 65, 64, 56, 55, 54, 53, 45, 25, 24
6	92, 91, 85

BOGOTA: Sector System Based on 1973 Comunas

<u>SECTORS</u>	<u>COMUNAS</u>
1	31
2	32, 25, 14, 13, 12, 11
3	45, 44, 24, 23, 22, 21
4	65, 43, 42, 41
5	64, 63, 62, 61
6	56, 55, 54, 52, 51
7	92, 91, 74, 73, 72, 71, 53
8	85, 84, 83, 82, 81
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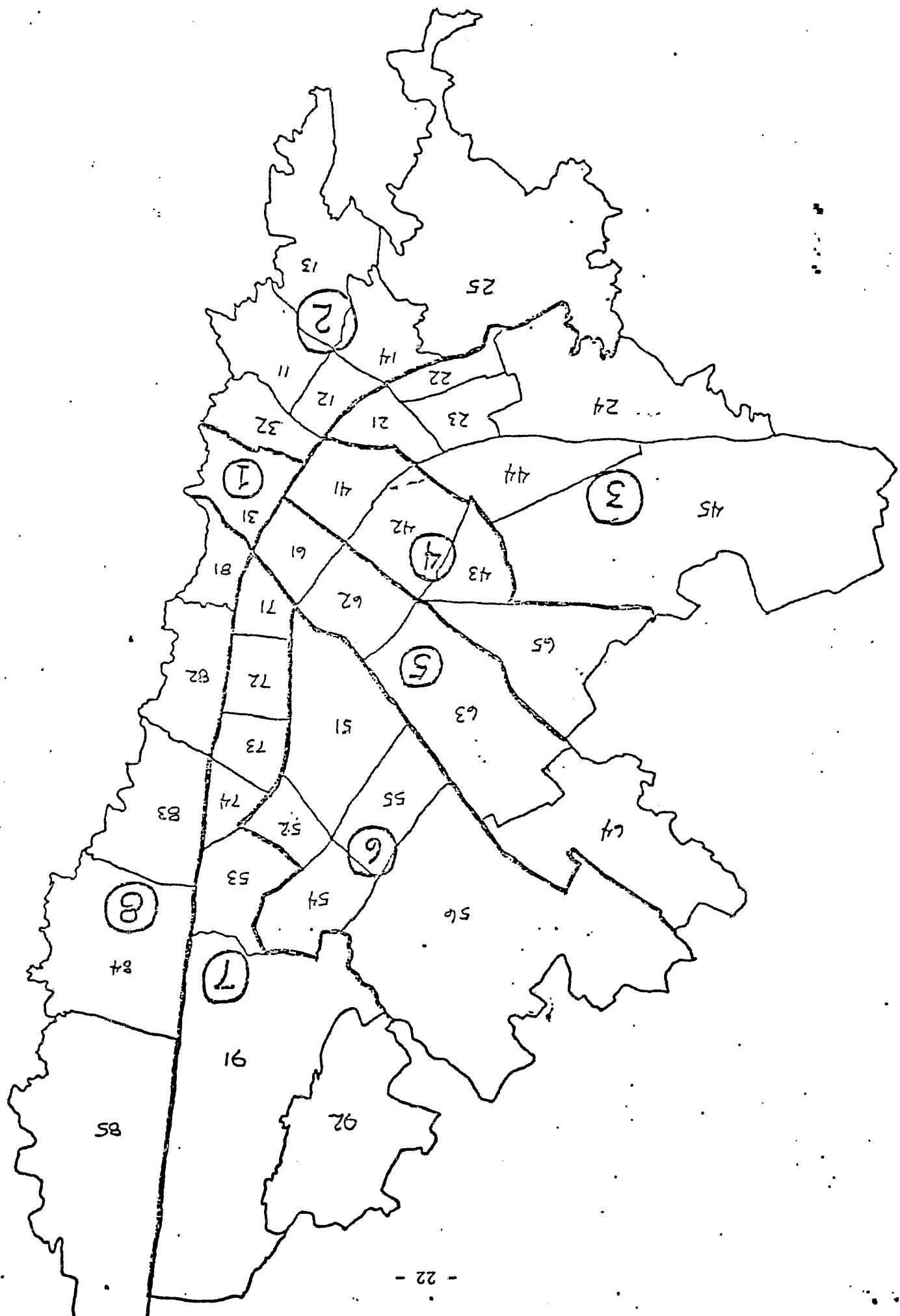


Figure II

CALI ZONE SYSTEM (Comunias)

Rings

- 1 - 12 (CBD)
- 2 - 11, 13, 14, 22, 23, 72, 73
- 3 - 21, 24, 31, 32, 41, 51, 52, 53, 71, 74
- 4 - 33, 42, 44, 54, 55, 61, 62
- 5 - 34, 43, 63

Sectors

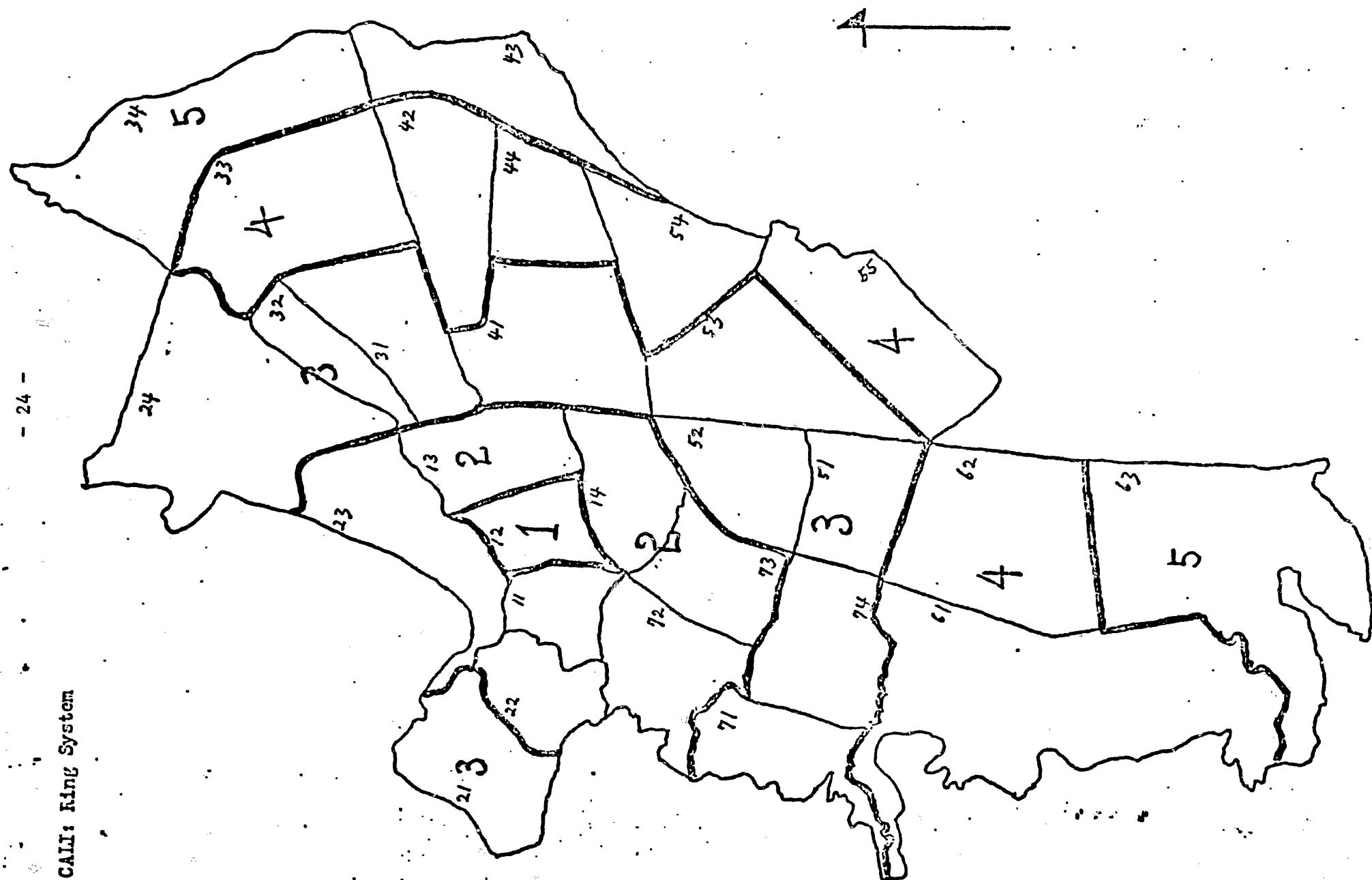
- 1 - 12 (CBD)
- 2 - 23, 24
- 3 - 13, 31, 32, 33, 34
- 4 - 41, 42, 43, 44
- 5 - 14, 51, 52, 53, 54, 55
- 6 - 71, 72, 73, 74, 61, 62, 63
- 7 - 11, 21, 22

Analysis Zones

1-1 - 12	2-3 - 24	3-4 - 33	3-5 - 34
	3-3 - 31,32	4-4 - 42, 44	4-5 - 43
2-2 - 23	4-3 - 41	5-4 - 54, 55	6-5 - 63
3-2 - 13	5-3 - 51, 52, 53	6-4 - 61, 62	
5-2 - 14	6-3 - 71, 74		
6-2 - 72, 73	7-3 - 21		
7-2 - 11, 22			

CALL: King System

- 24 -



CALI: Sector System

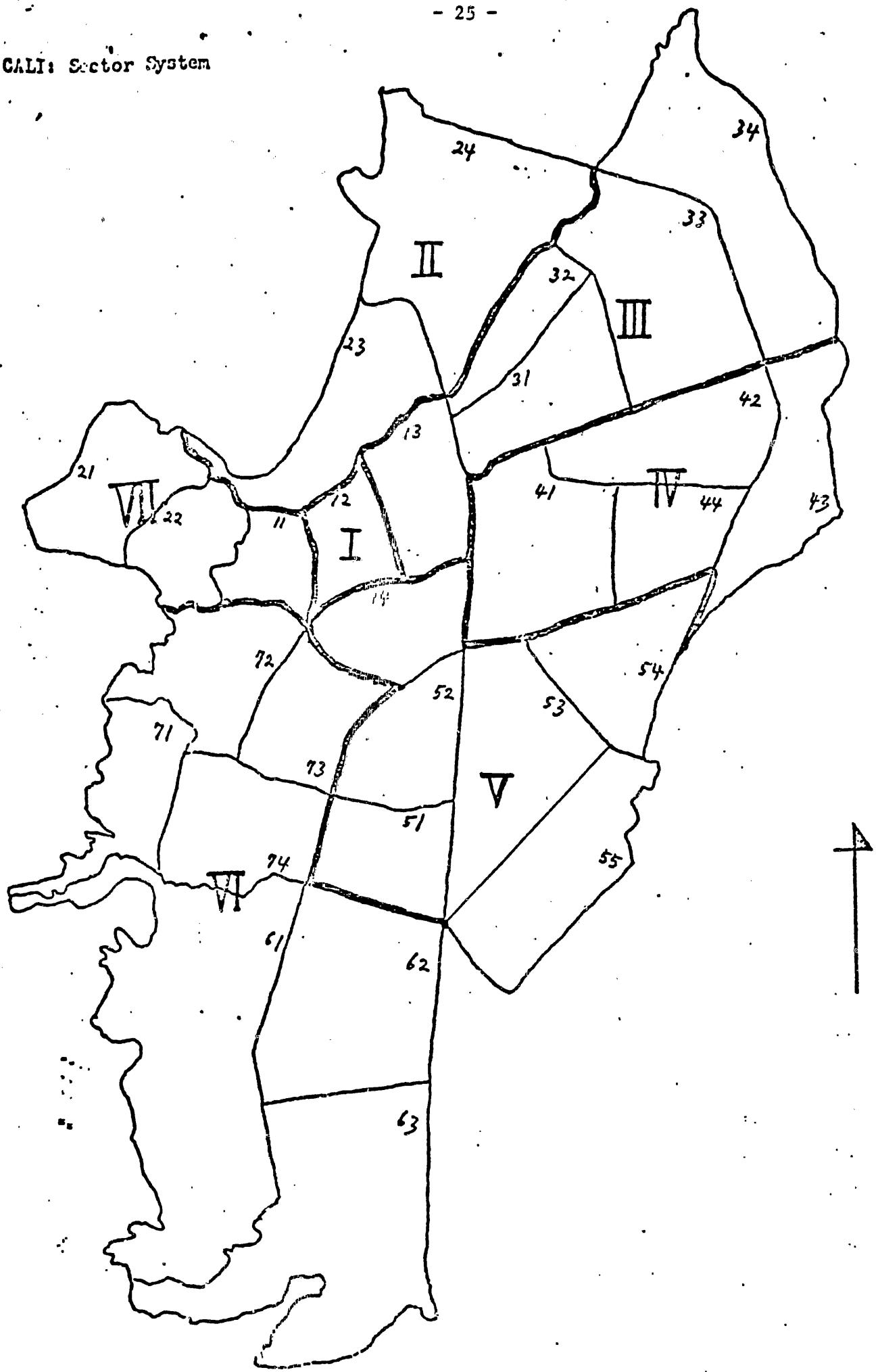


Table I-4

Ring and Sector Distribution of Households

	Bogota 1972 Number, Percent Total Households	Bogota 1978 Number, Percent Total Households	Cali 1978 Number, Percent Total Households
Ring 1	8,727 2%	21,375 3%	3,570 2%
Ring 2	53,471 11%	71,132 10%	45,942 21%
Ring 3	60,823 12%	95,413 13%	92,855 43%
Ring 4	171,900 34%	197,432 27%	58,140 27%
Ring 5	197,255 39%	301,834 41%	17,561 8%
Ring 6	<u>11,022</u> <u>2%</u>	<u>38,277</u> <u>5%</u>	— —
Total	503,198	725,463	218,068
Sector 1	8,727 2%	21,375 3%	3,570 2%
Sector 2	93,629 19%	144,639 20%	11,786 5%
Sector 3	131,058 26%	172,659 24%	36,615 17%
Sector 4	49,829 10%	49,770 7%	39,454 18%
Sector 5	38,003 8%	43,030 6%	85,643 39%
Sector 6	89,163 17%	127,548 18%	28,078 13%
Sector 7	58,737 12%	71,844 1%	12,922 6%
Sector 8	<u>34,052</u> <u>7%</u>	<u>94,598</u> <u>13%</u>	— —
Total	503,198	725,463	218,068

to note (Table I-5) that, in 1972 Bogota's Rings 4 and 5 fall below the Bogota average median household incomes, as do Sectors 2, 3, and 6. The 1978 results suggest that, either because of better data coverage or because of improvements in household income, fewer zones can be identified as "poor". Ring 5 and Sector 2 are still well below the city median, but Ring 4 and Sector 3 are close to the average, while Sector 6 is above it. Use of mean income data does not substantially alter the results. Rings 4 and 5 and Sectors 2, 3, and 6 are below average in 1972. Ring 5, Sector 2, and Sector 3 remain below the city wide mean in 1978; but Ring 4 and Sector 6 are either above or very close to the Bogota mean. Probing further, (Table I-6) one notes that in 1972 Ring 5 and Sectors 2, 3, and 6 contain low proportions of above-median households when compared to Bogota as a whole; they are, less clearly, the repositories of the poor, since only Ring 5 and Sectors 2 and 6 have above average concentrations of households earning \$1000 pesos or less. By 1978 the shrinkage in the number of "disadvantaged" areas is reconfirmed. Neither of the cited rings has an income distribution substantially different from that of the city, as defined by the categories in Table I-6. Sector 2 continues to contain disproportionately high proportions of poor households and low proportions of above-median income households. Sectors 3 and 6 do not have income "profiles" that differ markedly for the city as a whole.

Thus, using the less severe mean and median income tests for locational disadvantage, only Ring 5 and Sectors 2 and 3 can be said to be "poor" in both 1972 and 1978. The income distribution "profile" test would leave only Sector 2 as a poverty zone in 1978.

At the other end of the spectrum, Rings 2, 3 and 6 plus Sectors 7 and 8 have median and mean incomes well above the city average in 1972. This phenomenon holds in 1978 except for Ring 6, which falls below the median, while maintaining its high mean income rank. Using the income distribution profile for 1972 and 1978 reconfirms the results, with Ring 6 having an income distribution in 1978 rather similar to that of the city as a whole, but where the remaining areas appear better-off than their counterparts. Thus the ranks of prosperous zones appears more stable between the two surveys than that of the disadvantaged zones.

For Cali the pattern of differentiation persists. Rings 4 and 5 and Sectors 3, 4, and 5 all have median and mean incomes below the city-wide average. All zones show heavier proportions of poverty households and lower proportions of above-median income households. As in Bogota, two sectors (2,7) rank far above all others in income.

Table I-5

Mean and Median Household Incomes by Ring and Sector

	Bogota 1972		Bogota 1978		Cali 1978	
	Mean Income	Median Income	Mean Income	Median Income	Mean Income	Median Income
Ring 1	3,348	2,149	8,069	5,001	12,174	9,987
Ring 2	3,792	2,468	15,309	10,000	16,055	8,300
Ring 3	4,853	3,008	16,341	10,416	11,117	7,035
Ring 4	2,939	1,711	14,641	7,871	9,074	6,531
Ring 5	2,313	1,443	10,690	7,232	6,352	5,996
Ring 6	4,220	3,121	16,028	7,360		
Total	3,055	1,731	13,094	7,961	11,246	7,016
Sector 1	3,348	2,149	8,069	5,001	12,174	9,987
Sector 2	1,635	1,206	6,658	5,000	25,191	20,007
Sector 3	2,018	1,576	9,746	7,416	8,500	6,600
Sector 4	2,834	2,155	12,559	8,799	6,924	6,000
Sector 5	3,337	2,004	13,557	8,900	9,026	6,814
Sector 6	2,228	1,488	12,749	8,600	14,879	9,400
Sector 7	5,256	4,004	16,068	10,000	26,067	15,089
Sector 8	9,314	5,768	30,977	20,782	-	-
Total	3,055	1,731	13,094	7,961	11,246	7,016

1/ Data for 1972 derived from Alvaro Pachon, Urban Structure ..., op cit,  
Tables A-8 to A-21

Table I-6

Income Distribution of Households by Ring and Sector

	Bogota 1972 % Households			Bogota 1978 % Households			Cali 1978 % Households		
	% 1000 or less	% 1001 - 2000	% over 2000	% 4000 or less	% 4001 - 8000	% Over 8000	% 3500 or less	% 3501 - 7000	% Over 7000
Ring 1	20	27	53	43	23	34	13	34	53
Ring 2	16	25	59	25	20	55	18	22	60
Ring 3	11	23	66	12	19	69	20	30	50
Ring 4	23	35	42	23	28	48	23	32	.45
Ring 5	29	40	31	25	29	46	28	35	38
Ring 6	21	21	58	29	24	47			
Total	23	34	43	24	26	50	21	29	50
Sector 1	20	27	53	43	23	34	13	34	53
Sector 2	38	38	24	37	37	26	5	8	86
Sector 3	23	43	34	22	31	47	22	34	45
Sector 4	12	34	54	20	24	57	24	37	39
Sector 5	18	32	50	19	25	56	24	29	47
Sector 6	27	39	34	20	24	56	17	24	59
Sector 7	12	17	72	23	20	57	6	28	66
Sector 8	13	12	76	10	11	80			
Total	23	34	43	24	26	50	21	29	50

Unlike the distribution of household residences, the distribution of the work force by place of employment is quite highly dispersed. (Table I-7). In Bogota, no ring or sector exceeds 26% of the workforce total and that level only occurs in two instances (Ring 1 in 1972 and Ring 5 in 1978). Even this level of concentration is open to question, at least in the case of Ring 1 (Sector 1). The reported proportion of employment in that ring declines sharply from 26% in 1972 to 15% in 1978 and falls in absolute terms as well. There is a dearth of alternate information on employment location in Bogota. However, one study compared the Phase II results for manufacturing employment with information from a comprehensive industrial directory with data for 1970 through 1975. That work suggests that Phase II severely overestimated the number of manufacturing workers in the Ring 1-Sector 1 zone and underestimated the shares of other zones.<sup>14/</sup>

In Cali, the Central Business District (C.B.D.) (Ring 1, Sector 1) is roughly comparable to Bogota in terms of the proportion of employment captured in 1978 (18% vs. 15%) and only two zones contain more than one-quarter of the employment (Ring 2: 28%; Ring 3: 35%). The relatively low percentage of total employment found in the central core is significant, for it highlights the difficulty of using simple models of urban behavior which assume monocentricity, i.e., the almost total concentration of workers in the C.B.D. Instead what prevails is a multicentric system with significant proportions of employment found in most rings and sectors.

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<sup>14/</sup> See Alvaro Pachon, Urban Structure ..., op cit, Chapter 3, Section 4 and Table A.23. Unfortunately the data review by Pachon covers only manufacturing employment for firms with 10 or more workers. Thus the decline could have occurred among small manufacturing firms or among other types of employment.

Table I-7

Distribution of Workers by Zone of Employment

	Bogota 1972, Total Workers Working		Bogota 1978, Total Workers Working		Cali 1978 Total Workers Working
Ring 1	201,975	26%	166,878	15%	59,832
Ring 2	117,887	15%	214,525	19%	94,624
Ring 3	128,288	16%	182,104	16%	118,391
Ring 4	162,977	21%	245,418	21%	51,719
Ring 5	160,660	20%	299,137	26%	10,248
Ring 6	14,442	2%	39,652	3%	
Total	786,229		1,147,713		334,814
Sector 1	201,975	26%	166,878	15%	59,832
Sector 2	60,205	8%	101,655	9%	38,399
Sector 3	105,928	14%	159,254	14%	71,682
Sector 4	73,875	9%	108,230	9%	44,704
Sector 5	86,439	11%	141,952	12%	63,213
Sector 6	72,970	9%	143,334	13%	41,411
Sector 7	78,582	10%	116,905	10%	15,573
Sector 8	106,255	14%	209,505	18%	
Total	786,229		1,147,713		334,814

Summary

What one finds in Bogota and Cali are cities of considerable size populated by households which, in the main, have fairly high incomes by the standards of the developing world. The household heads tend to be young, with a median age of about 40 years, overwhelmingly male and not natives of the city of present residence. The latter fact does not seem to be associated with widespread "marginalization", as comparisons of the household incomes of native and non-native households demonstrates. The households typically include 5 members and that size seems to be declining over time. These households live in low density environments, where houses are the predominant type of residential structure. Furthermore, roughly half of the dwellings are owned by their occupants. This in no sense is a world of tenement dwellers.

Both Bogota and Cali display fairly pronounced spatial features in the distribution of residences and work places. Residences are more concentrated in particular zones than jobs and in neither case is there a pronounced tendency to live or work near the core. Using zonal median and mean household incomes, or the distribution of households among income strata meant to separate the "poor" from the more affluent, one can identify particular areas of each city which are "affluent" or "disadvantaged", though the presence of two sets of data for Bogota produces conflicting results in defining "disadvantaged" areas.

## SECTION II. FACTORS AFFECTING HOUSEHOLD MOBILITY RATES

### Mobility Rates

One variable of interest to policy-makers is the degree to which the urban landscape changes over short periods of time. Residential mobility in Bogota is significant, as suggested by both Phase II and the 1978 Survey. Thus, if "recent movers" are defined as those who moved in 1971-1972 (up to 2 years) <sup>1/</sup>, then these households accounted for 33% of those in place at the time of the 1972 survey. One need only go back 3 1/2 years (1969-1972) to encompass the time period during which slightly more than half of the households moved prior to being at their present location. 1978 data confirms this finding, while adding further detail. Approximately 23% of all households had lived less than one year at their current dwelling, while 35% had lived less than two years at their present address. One need go back less than four years to find that just over half of the households had relocated.

Of interest, as well, is the impact of city size on this phenomenon. Cali, in 1978, displays very similar behavior patterns to those found in Bogota. Thus, 23% of the households had resided at their present address for less than one year, 33% for less than two years, and 54% for less than four years.

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<sup>1/</sup> Phase II does not permit the identification of moves made "within the last year".

One major longitudinal study of moving behavior exists for Bogota. It is based on interviews conducted by Robert Corno in 1975 with adults 20 to 45 years of age. Among those with a residence in Bogota at the start of 1970, one move was made, on average, by the time of the survey, 4.5 to 5 years later. There is little evidence of hypermobility except among a very reduced number of adults. Thirty-seven percent never moved, while 32% made only one move. Sixteen percent made two moves, while 14% made 3 or more moves during the 5 years. "Nomadic" behavior is thus a fairly restricted phenomenon, even among this, the most mobile part of the population.

The relevant finding therefore is that there is considerable mobility over time, that the rates seem to be stable over time and across cities, and, as noted below, that the underlying factors explaining mobility fit plausible behavioral models.

#### A Review of Descriptive Statistics

Before examining a model of recent mobility as a function of household characteristics and certain other independent variables, a review of a few descriptive statistics is warranted. It should be noted, here as elsewhere, that the impact of any independent variable on a dependent variable in the descriptive sections momentarily ignores the simultaneous impact of other independent factors. It is only in the simple modeling efforts at the end of each major section that the impact of individual independent variables can be judged. Furthermore many of the descriptive data are presented in aggregate form, for the sake of simplicity. The

impact of the age of the household head on mobility rates, for example, is discussed in the descriptive sections, using broad category variables like "30 years of age or younger", "31 to 40 years of age" and "over 40 years of age". An attempt has been made to ascertain, ahead of time, that this level of aggregation captures the essence of the more detailed information available from the surveys themselves. Nevertheless some interesting detail is inevitably lost.

#### Mobility and Household Income

Income, in and of itself, could have contradictory impacts on mobility. Higher incomes could increase the ability to move; they could, simultaneously, be associated with consumption/investment decisions (e.g. the high transactions costs associated with selling a house prior to moving) which increase the difficulty of relocating compared to that experienced by lower income households. The data was examined, with income defined solely as the reported labor and non-labor of the household. It was assumed that the income of the household head alone was unlikely to reflect the true purchasing power available when considering whether or not to move from one dwelling to another. It was also decided that the imputed income to homeowner households should be excluded so that the results could be made more comparable to that of other research already conducted in this field in other countries.

Table II-1 suggests that some income effect does exist. Lower income households are more mobile than other income groups, especially those with above median incomes. The mere ability to move, presumed to be

Table II-1

Recent Movers Versus Non-Movers by Household Income Category

A. Bogota, 1972

	<u>Household Income (pesos/month)</u>			
	<u>Up to 1000</u>	<u>1001-2000</u>	<u>Over 2000</u>	<u>Total</u>
Moved During 1971-1972	41%	32%	28%	33%
Non-Mover	59%	68%	71%	67%
Total	100%	100%	100%	100%

B. Bogota, 1978

	<u>Household Income (pesos/month)</u>			
	<u>Up to 4000</u>	<u>4001-8000</u>	<u>Over 8000</u>	<u>Total</u>
Moved Within Last Year	29%	27%	17%	22%
Non-Mover	71%	73%	84%	78%
Total	100%	100%	100%	100%

C. Cali, 1978

	<u>Household Income (pesos/month)</u>			
	<u>Up to 3500</u>	<u>3501-7000</u>	<u>Over 7000</u>	<u>Total</u>
Moved Within Last Year	27%	26%	19%	22%
Non-Mover	73%	74%	81%	78%
Total	100%	100%	100%	100%

positively associated with income is countered by other effects. This tendency is evident in all three cases examined. Having made that point, it should also be noted that only 8 to 12 percentage points separate the better off from the poorer households in terms of the proportions classifying themselves as recent movers. The 1978 data, furthermore, suggests very little difference in the behavior of poorer and intermediate income households, so that only groups with above median incomes show a detectable tendency to move less than their counterparts.

A final cautionary note is in order. There is every reason to expect that changes in behavior such as a decision to move are related to an income variable more complex than the one explored here. Changes in income prior to a move or expected changes in income following a move, for example, may be far more realistic descriptions of the "true" independent variable. Similarly it would be useful to have income data purged of elements which are viewed by the households as purely transitory in nature, in either a downward or upward direction. Such data are simply not available from our samples and their absence may give the income variable a less prominent role than it deserves.

#### Mobility, Income and the Number of Contributing Workers

One noticeable feature among roughly half of the households in the surveys is that secondary workers are present.<sup>2/</sup> Among the latter type of household, secondary workers supply half or more of the household income in 56% - 57% of the cases. <sup>3/</sup>

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2/ 46% of the households in Bogota (1978) and 48% of the households in Cali. In 1972, 46% of Bogota's households had multiple workers.

3/ Information on this question is not available from the 1972 survey.

It is possible that the presence of secondary workers discourages or encourages mobility. It may discourage it by complicating the decision-making process, which is otherwise presumably straightforward. It may encourage it by creating additional pressures to relocate in response to the changing demands of multiple decision-makers. The existing surveys suggest that, ignoring other variables, there is a slight tendency for multiple worker households to move less often: (Table II-2). Aside from the cited factors, the average multiple worker household has higher incomes and older household heads than an otherwise comparable average single-worker household. To the extent that rising incomes and more advanced age discourage mobility, the existence of multiple workers could be a reflection of that phenomenon.

Mobility and Selected Household Characteristics

The age of the household head appears to be a very good predictor of mobility (Table II-3). Younger household heads are much more likely to move than older ones as one examines the data across three age categories (30 and under, 31 to 40, over 40). While the intermediate age category approximates the city-wide average, the younger household heads are always twice as likely to move as the average household. This implies that between 40% (1978) and 60% (1972) of the young households changed residences in the most recent past. By contrast 80% to 90% of the older household heads (over 40 years of age) are listed as non-movers in the relevant time period.<sup>4/</sup> This phenomenon may have various explanations. Among these the most plausible

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<sup>4/</sup> Discrepancies between 1972 and 1978 results are created by the fact that time frame for a "recent move" is longer when 1972 data are used.

Table II-2

Recent Movers Versus Non-Movers by Household  
Number of Workers

A. Bogota 1972

	<u>Household Workers</u>			
	0	1	2 or more	Total
Moved During 1971-1972	26%	36%	28%	32%
Non-Mover	74%	64%	72%	68%
Total	100%	100%	100%	100%

B. Bogota 1978

	<u>Household Workers</u>			
	0	1	2 or more	Total
Moved Within Last Year	19.0%	24%	20%	22%
Non-Mover	81.0%	76%	80%	78%
Total	100%	100%	100%	100%

C. Cali 1978

	<u>Household Workers</u>			
	0	1	2 or more	Total
Moved Within Last Year	15%	28%	18%	23%
Non-Mover	85%	72%	82%	77%
Total	100%	100%	100%	100%

Table II-3

Recent Movers Versus Non-Movers by Household Head Age Category

A. Bogota 1972

	<u>Household Head Age</u>			
	30 and under	31-40	Over 40	Total
Moved During 1971-1972	58%	37%	20%	32%
Non-Mover	42%	63%	80%	68%
Total	100%	100%	100%	100%

B. Bogota 1978

	<u>Household Head Age</u>			
	30 and under	31-40	Over 40	Total
Moved Within Last Year	41%	21%	14%	23%
Non-Mover	59%	79%	86%	77%
Total	100%	100%	100%	100%

C. Cali 1978

	<u>Household Head Age</u>			
	30 and under	31-40	Over 40	Total
Moved Within Last Year	42%	25%	13%	23%
Non-Mover	58%	75%	87%	77%
Total	100%	100%	100%	100%

is that age is a proxy for "stability". Younger household heads are generally at the start of the life cycle as adults, less well informed about residential and employment markets, and less able to define their long-term preferences. Older households are much more likely to be homeowner households, with the transactions costs barriers to mobility already cited. The younger households are less likely to be settled in other respects as well. Moves may occur because of changes in marital status, increasing household size, and changing job locations.

The latter hypothesis, in particular, would be an interesting one to examine. Unfortunately no survey conducted to date traces the location of any job prior to the present one, robbing the analyst of a rich data source. Indirect evidence on the possible role of job mobility on residential moves exists for 1978 (Table III-4). Household heads in Bogota who changed jobs within the previous year are twice as likely to be classified as recent movers than non-movers; fully 40% of those changing jobs were recent movers compared with only 20% of those who did not change employment. The evidence from Cali yields even stronger results: almost 50% of those changing jobs were classified as moving in the last year while only 20% of longer-term worker household heads were among the recent movers. Unfortunately the nature of those job changes are unknown. We do not have any information for example, on the impact of those changes involving a significant increase or decrease in commuting from the residential site occupied prior to the employment change.

Table II-4

Recent Mover Versus Non-Mover by Whether Household Head Changed Jobs Within Last Year

A. Bogota 1972

N.A.

B. Bogota 1978

Residential Mobility	Job Tenure	Under 1 Year	1 Year and Over	Total
Moved Within Last Year		40%	20%	23%
Non-Mover		60%	80%	77%
Total		100%	100%	100%

C. Cali 1978

Residential Mobility	Job Tenure	Under 1 Year	1 Year and over	Total
Moved Within Last Year		49%	21%	26%
Non-Mover		51%	79%	74%
Total		100%	100%	100%

Marital status, defined as whether the household head has or does not have a spouse, proves to have little bearing on mobility. Like older households, the more mobile younger households are likely to have a spouse in residence; this is the case of 79% of the households with a head 30 years of age or younger in Bogota 1972, 70% of the cases in Bogota 1978, and 67% of those in Cali. The reported information does not, of course, exhaust the possible role of these types of variables on mobility. One could hypothesize that higher rates of mobility for the "footloose" household heads can only be uncovered given information on changes in marital status. The most obvious test of the role of marital status on mobility would be to relate changes in such status with changes in residence location. Such a comment could be extended to virtually all variables other than age, which, by definition carries within it an automatic past history.

The sex of the household head yields only small differences in mobility rates. In both Bogota surveys, male- and female- headed households have similar rates of mobility. In Cali households headed by females have slightly lower rates than those of their counterparts. This occurs even though one might assume that female-headed households are less likely to benefit from the income or asset accumulation possibilities open to male headed households, either because of the presence of discrimination in the labor market, the presence of fewer household members in the labor market, or reduced opportunities for mobility-reducing homeownership. In fact, homeownership among female-headed households is as high as among male-headed households <sup>5/</sup> though their income profiles do, in fact, suggest that female-

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5/ See Section IV.

headed households are less well-off than their male-headed counterparts (Table II-5). In both Bogota and Cali, the female-headed households are overrepresented in the lowest income category and underrepresented in the highest income category. We have thus a case where asset acquisition has taken place regardless of a relatively disadvantageous income profile, and that, in turn, has apparently lifted female-headed households to near parity rates of mobility with their male-headed counterparts.

One variable that has a link to mobility and may contribute to explaining the higher mobility of younger household heads is household size (Table II-6). Smaller households are more likely to move than larger households, when above and below mean sizes are considered <sup>6/</sup>. Again the critical information which is lacking is whether increasing or decreasing household size in the period concurrent with or immediately preceding the recent past is in fact correlated with moving behavior. There is little doubt, however, that younger households are smaller than older ones, as noted in Table II-7. Households whose heads are 30 years old or younger have at least twice the proportion of members in the smallest household size category (1-3) as their older counterparts. The situation prevails both in 1972, and in 1978, even though, in the interval, household sizes had shrunk in Bogota. While the cross-sectional conclusions should be considered with caution and we should not expect younger households to match the numbers achieved by their older counterparts in a world of shrinking household sizes, the data do suggest that younger households are likely to

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<sup>6/</sup> The sizes vary over time, as noted. The mean is proxied here by a household size of 5 for all three cases studied.

Table II-5

Household Income by Household Head Sex

A. Bogota 1972

Income Category (pesos/month)	<u>Household Head Sex</u>		
	Male	Female	Total
Under 1000	21%	34%	23%
1001-2000	35%	30%	34%
Over 2000	44%	36%	43%
Total	100%	100%	100%

B. Bogota 1978

Income Category (pesos/month)	<u>Household Head Sex</u>	
	Male	Female
Under 4000 pesos	21%	37%
4001-8000 pesos	27%	28%
Over 8000 pesos	52%	35%
Total	100%	100%

C. Cali 1978

Income Category (pesos/month)	<u>Household Head Sex</u>	
	Male	Female
Under 3500 pesos	16%	34%
3501-7000 pesos	30%	27%
Over 7000 pesos	54%	39%
Total	100%	100%

Table II-6

Recent Mover Versus Non-Mover by Household Size

A. Bogota 1972

	<u>Household Size</u>		
	1-5	Over 5	Total
Moved in 1971-1972	39%	24%	32%
Non-Mover	61%	76%	68%
Total	100%	100%	100%

B. Bogota 1978

	<u>Household Size</u>		
	1-5	Over 5	Total
Moved Within Last Year	27%	14%	23%
Non-Mover	73%	86%	77%
Total	100%	100%	100%

C. Cali 1978

	<u>Household Size</u>		
	1-5	Over 5	Total
Moved Within Last Year	27%	15%	23%
Non-Mover	73%	85%	77%
Total	100%	100%	100%

Table II-7

Household Size by Household Head Age

A. Bogota 1972

Household Size	<u>Household Head Age</u>		
	30 Years and under	31-40	Over 40
1-3	43%	14%	17%
4-6	48%	56%	40%
Over 6	9%	31%	43%
Total	100%	100%	100%

B. Bogota 1978

Household Size	<u>Household Head Age</u>		
	30 Years and under	31-40	Over 40
1-3	53%	21%	26%
4-6	42%	62%	44%
Over 6	5%	17%	30%
Total	100%	100%	100%

C. Cali 1978

Household Size	<u>Household Head Age</u>		
	30 Years and under	31-40	Over 40
1-3	54%	22%	30%
4-6	39%	22%	39%
Over 6	7%	16%	31%
Total	100%	100%	100%

experience the household size growth which could induce mobility in search of larger quarters. <sup>7/</sup>

Tables II-8 and 9 relate tenure choice to mobility and suggest an important link between the two. Unambiguously, a majority or near-majority of households renting at the time of the survey moved within the recent past, while 85% - 95% of the owners did not. Furthermore, 1972 data allows us to characterize movers as far more likely than non-movers to be households with a history of renting. <sup>8/</sup> While only 47% of the households in 1972 were renters, fully 69% of the movers in 1971-1972 were both previous and present renters. Non-movers are more likely to have gone from renting to owning their dwelling or from selling to acquiring another unit. Approximately 68% of the non-movers fall into these two categories. The relative immobility of the "first-time" homeowners, only 14% of whom moved in 1971-1972, is a particularly interesting finding, even if based on only two tenure choice observations. 1978 data has no information on prior tenure choice, while 1972 data has no information on the length of the time in the prior residence. Certain obvious hypotheses cannot be tested. However, Table II-8 does suggest that households with short prior tenures are about as likely to move as not to move in the year prior to the survey, while households that

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- 7/ The reverse phenomenon, shrinking household size, could also have an impact on mobility. However, its occurrence among older households would mean that, typically, the transactions costs of adjustment would be heavier than among younger households because of the fact that older households would also be homeowners. (Roughly 70% of those households headed by individuals over 60 own their dwellings).
- 8/ This conclusion is based on the tenure of only the immediate past residence. It can be established only on the basis of Phase II data.

Table II-8

Recent Movers Versus Non-Movers by Tenure Choice

A. Bogota 1972 - Version I

Moving Behavior \ Tenure Choice	Own-Own	Own-Rent	Rent-Own	Rent-Rent	Total
Moved in 1971-1972	18%	56%	14%	53%	33%
Pre-1971 Move	82%	44%	86%	47%	67%
Total	100%	100%	100%	100%	100%

B. Bogota 1972 - Version II

Moving Behavior \ Tenure Choice	Own	Rent	Total
Moved in 1971-1972	15%	54%	32%
Non-Mover	85%	46%	68%
Total	100%	100%	100%

C. Bogota 1978

	Present Tenure Status		
	Own	Rent	Total
Moved Within Last Year	8%	37%	23%
Non-Mover	92%	63%	77%
Total	100%	100%	100%

D. Cali 1978

	Present Tenure Status		
	Own	Rent	Total
Moved Within Last Year	5%	43%	23%
Non-Mover	95%	57%	77%
Total	100%	100%	100%

Table II-9

Recent Mover Versus Non-Mover by Time Spent at Last Residence

A. Bogota 1972

N.A.

B. Bogota 1978

	<u>Previous Tenure Time</u>		
	Under 1 Year	Over 1 Year	Total
Moved Within Last Year	45%	20%	23%
Non Mover	55%	80%	77%
Total	100%	100%	100%

C. Cali 1978

	<u>Previous Tenure Time</u>		
	Under 1 Year	Over 1 Year	Total
Moved Within Last Year	49%	20%	24%
Non-Mover	51%	80%	76%
Total	100%	100%	100%

lived longer in the prior residence (over 1 year) have mobility rates much more like the average for the city as a whole. We can draw two conclusions from this. The first is unambiguous: among recent movers there is a contingent of households that appears to be hypermobile.<sup>9/</sup> The second can be inferred from the high proportion of renters, both former and present, among the movers: renters are likely to have a lesser commitment to the dwelling than owners and be less reluctant to relocate residences over time.

Having discovered that migrant households who arrived in the last five years have considerably younger household heads than households taken as a whole<sup>10/</sup>, and that their incomes are more likely to be below average, we can deduce that their residential mobility within the recent past is high. This would be all the more likely since this group is overwhelmingly in the renter/usufructuary category.<sup>11/</sup> Table II-10 confirms this finding, suggesting that migrants who arrived in the city within the last five years prior to the survey are as likely to record a recent change in residence as not. Longer-term residents, on the other hand, have moving rates below the city average, confirming our expectations. This occurs

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<sup>9/</sup> In 1978, 18% of the recent movers in Bogota had lived in the prior address less than one year. For Cali, the proportion rises to 22%. Forty-one percent (Bogota) to 47% (Cali) of the recent movers had lived fewer than two years at the previous address. Among non-movers in both cities the proportions with short prior tenure, defined as under one or under two years, are always less than half the rates recorded among the recent mover group.

<sup>10/</sup> From Section I, one can see that among such migrants, households heads 30 years of age or younger are twice as high as for the population as a whole.

<sup>11/</sup> See Section IV.

Table II-10

Recent Movers Versus Non-Movers by "Recent Migrant"  
Status of Household Head

A. Bogota 1972

Moving Behavior	Migrant Status	Under Two Years in Bogota	Two to Six Years in Bogota	Over Six Years in Bogota	Total
Moved in 1971-72		84%	53%	27%	32%
Pre-1971 Move		16%	47%	73%	68%
Total		100%	100%	100%	100%

B. Bogota 1978

Moving Behavior	Migrant Status	Under Two Years in Bogota	Two to Six Years in Bogota	Over Six Years in Bogota	Total
Moved Within Last Year		66%	34%	18%	22%
1 Year and over		34%	66%	81%	78%
Total		100%	100%	100%	100%

C. Cali 1978

Moving Behavior	Migrant Status	Under Two Years in Cali	Two to Six Years in Cali	Over Six Years in Cali	Total
Moved Within Last Year		68%	30%	20%	23%
1 Year and over		32%	70%	80%	77%
Total		100%	100%	100%	100%

even when care is taken to separate out the most recent arrivals who, by definition, will have very high positive responses to a question concerning short length of residence at the present site. Thus the data allow one to separate out individuals who moved to Bogota up to, but not including, two years prior to the survey. These individuals have the highest rates of recent mobility: 84% in Bogota 1972, 66% in Bogota 1978, and 68% in Cali 1978. <sup>12/</sup> Those household heads who arrived between 2 and under 6 years before the survey also have high rates of recent mobility: 53% in Bogota, 1972, 34% in Bogota 1978, and 30% in Cali 1978. In each of the latter cases, the household heads with even longer residence in the city show correspondingly lower rates of recent moves in residential location.

It should be noted that what cannot be established at this stage in the analysis is whether the recent migrant has characteristics peculiar to that status and independent of the age and income effects. To the extent that such an effect is apparent it presumably is based on the fact that the recent migrant has to make residential decisions with less information than his counterparts. Mobility would then be symptomatic of the learning experience that allows for later, more permanent locational choices.

There is a final variable of interest. One can postulate a hypothesis that the behavior of households is affected by the area of residence.

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12/ The Bogota 1972 rates of recent residential mobility for recent migrants are higher than those recorded in 1978 because recent residential mobility includes a time period well in excess of one year. The 1978 results always reflect a definition of recent residential mobility as that taking place within one year prior to the survey.

This locational disadvantage hypothesis suggests that, once a resident of a particular sector,<sup>13/</sup> a household head develops behavioral traits that link him to his zonal cohorts. In particular, it suggests that residents of poorer sectors might be locked into a behavioral pattern which translates into reduced mobility; the search for residences and jobs is somehow curtailed and the opportunities that flow from limited searches feed back on acquired characteristics (level of education, for example) to produce perpetual low status. The hypothesis is obviously familiar to those who have examined the literature on the ghetto-bound black population in the United States.

One initial test of this hypothesis is whether or not mobility per se is linked to the sector of previous residence. Here, as elsewhere, one needs to be reminded that all other independent variables are not being held constant and that any patterns may simply reflect the impact of other factors correlated with zone of origin.

The cross-tabular evidence (Table II-11) suggests that zone of previous residence may have some, limited impact on mobility per se. The rates of mobility tend to fluctuate in a relatively narrow band around the city-wide average and the "outlier" zones are both poor and rich. Thus in Bogota, evidence from 1972, suggests an average moving rate of 33%, with all sectoral observations falling within a band 20% above or below that rate. Nevertheless, within that rate, the poorest sectors (2, 3, 6) have the higher moving rates and the better-off sectors (7, 8) have the lower moving rates.

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13/ While the test could also utilize ring data, there are several reasons for discarding ring classifications in discussing the hypothesis. These are presented in detail in Section III.

Table II-11

Recent Movers Versus Non-Movers by Location of  
Prior Residence Sector

A. Bogota 1972

B. Bogota 1978

C. Cali 1978

In 1978, there are only two cases in Bogota where rates of mobility deviate by more than 5 percentage points from the average: Sector 6 (whose income characteristics resemble those of Bogota as a whole) and Sector 7 (which is a "better-off" zone). Sector 6 has above average rates of mobility; Sector 7 has below average rates of mobility. A poor area, like Sector 2, has roughly the same mobility rates as Sector 8, a "rich" sector of Bogota. For Cali the evidence is similar, Sector 2, the richest one in the city, has mobility rates perceptibly below the average, as does Sector 1, an area with income characteristics rather similar to those of the whole city. The highest mobility rates are found in Sector 6, an area of intermediate income characteristics and a zone undergoing rapid development. Poor zones like Sectors 3, 4 and 5 have mobility rates virtually indistinguishable from those of the "rich" Sector 7.

Several hypotheses, other than those originally mentioned, remain untested. Not only do household characteristics change, in ways not detected by our surveys, but their immediate neighborhoods may undergo transformations which samples such as those examined simply do not detect. Households may move and do so in particular patterns as a result, in part, of the "push" of neighborhood inadequacies and/or the "pull" of amenities in alternate locations. The surveys are simply not intended to replicate such changes at a micro level when the samples are "expanded" to provide profiles of more aggregate zones of the cities in question. Phenomena operative at the neighborhood level, in other words, may be obliterated by aggregation. The reinforcement provided to such "push/pull" factors by changes in household characteristics (which might change a household's

perception of an otherwise relatively unchanged set of neighborhoods) is, as already noted, also undetectable.

A Simple Model of the Decision to Move

To what extent can cross-tabular conclusions be trusted? It is clear that such information fails to control for the concurrent effect of other variables which are not being held constant. A first test of the reliability of such tables is the use of multiple regression model with a dichotomous dependent variable where "1" represents "recent movers", estimated with an ordinary least squares (OLS) procedure. There are several objections to the use of OLS in models with a dichotomous dependent variable. First, it violates the homoscedasticity assumption. In other words, even though the mean of the disturbance term might still be zero, the variance of the disturbance term is no longer zero. The presence of a heteroscedastic disturbance term means that the estimated parameters might still be unbiased but they are no longer the most efficient estimates. <sup>14/</sup> A second and more fundamental objection is that the functional form is incorrect, leading to both biased and inconsistent estimates. Furthermore, given an incorrect specification, one cannot make any theoretically correct statements about the nature of the resulting estimates. One reason why the specification may be incorrect is that the predicted values need not necessarily fall between "0" and "1", something that is clearly nonsensical in a probabilistic setting. Casual empiricism suggests that non-linear functions with an S-shape are more applicable than linear additive specifications used in most OLS estimations. The usual transformations of the

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<sup>14/</sup> This objection can be solved by using a generalized least squares estimation method, improving the efficiency by reducing the variance of the estimated parameters.

independent variables are not very effective as long as the dependent variables remain dichotomous. Therefore, a better specification would involve the transformation of the dependent variable into a continuous variable.

Despite the above criticism, there are still reasons for using OLS for models with dichotomous dependent variables, especially in the initial stages of a modelling exercise. First, given that the true model has a general S-shape, the linear model could still approximate the true model in the mid-range of the probabilities. In other words, if the mean probabilities of the underlying sample falls between 0.25 and 0.75, then the OLS estimates can be assumed to be a fairly good approximation of the true values. This observation has been supported by Monte Carlo simulation studies comparing OLS and LOGIT results. Second, in most cases, it is the behavior of the observations that are in this mid-range that is the focus of interest, reinforcing the interest in OLS results. Third, many of the previous studies of this kind have utilized OLS procedures; its use, with new data, could thus prove instructive to some readers. Finally, the cost and restrictions associated with the use of more sophisticated estimation procedures can be quite high, justifying the generation of a comparison of the results of the two methods to see if LOGIT methods yield vastly different results.

One final note is appropriate. While tenancy was found to be associated with mobility rates in the cross-tabulations, it was omitted as a variable in the equations discussed below. Tenancy decisions are linked, in

Section IV, to the same types of variables listed in this section. Furthermore, there is no information on prior tenancy in the 1978 survey. For that reason, it was deemed preferable to omit any tenancy variable.

#### OLS and LOGIT Results Compared

The expectations derived from the cross-tabular exposition are generally borne out by the two multivariate estimations.<sup>15/</sup> This can be seen from examining Tables II-12 and II-13. For the variables "income", "age", "family size", "years in previous dwelling", "years on job", and "recent migration" the direction of association is the same as suggested by the descriptive statistics. The cross-tabulations do not point to any discernible relationship between the probability of move and the variables "sex", "marital status (couples)", and "(disadvantaged) sector of origin". The estimations confirm this by labelling all relevant coefficients insignificant. The OLS and LOGIT estimation do, however, generate different signs in three instances: "sex" in Cali and Bogota, and "(disadvantaged) sector of origin" in Bogota. The remaining variable "number of workers in the household" produces no unambiguous result in the cross-tabulations when zero worker households are included. If only households with workers present are considered, however, the cross-tabular relation is negative while the LOGIT and OLS coefficients all have positive signs; only in the Bogota OLS case is the coefficient significant. This difference in signs apparently reflects the effects of family size on the cross tabulation in question. <sup>16/</sup>

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<sup>15/</sup> The analysis is confined to the 1978 data, where variables like income and household head age are expressed in continuous form. In the 1972 survey data these variables are presented in intervals. All coefficients are comparable, the LOGIT results having been transformed and made equivalent to the OLS results.

<sup>16/</sup> The association between these two variables in the correlation matrix is 0.462 (Bogota) and 0.508 (Cali).

Table II-12

Estimation of Probability of Move < Bogota 78>  
Comparison of OLS and LOGIT

	<u>OLS</u>	<u>1/</u>	<u>LOGIT</u>	<u>5/</u>	<u>Sample Mean</u>	<u>7/</u>
Constant	1.602	(10.15)	*	0.768	(3.46)	
Income	-0.005	( 1.99)	-0.010	(2.53)	12.30	
Income Squared	0.00004	( 1.99)	0.0001	(2.11)		
Age	-0.037	( 5.03)	-0.018	(1.65)	41.34	
Age Squared	0.0003	( 3.69)	0.0001	(0.71)		
Family Size	-0.099	( 3.43)	-0.096	(2.65)	4.92	
Family Size Squared	0.006	( 2.54)	0.005	(1.63)		
Sex (F = 1)	-0.020	( 0.34)	0.003	(0.04)	0.186	
YRPVDU <u>2/</u>	-0.003	( 1.23)	-0.003	(0.75)	5.30	
YRJOB <u>3/</u>	-0.005	( 2.17)	-0.005	(1.47)	6.08	
Number of Household Workers	0.049	( 2.51)	0.020	(0.79)	1.72	
Household Head						
Migrant <u>4/</u> (Yes=1)	0.198	( 2.74)	0.382	(3.96)	0.053	
Couples (Yes=1)	0.077	( 1.32)	0.072	(1.04)	0.781	
Origin Sector (2,3=1)	0.007	( 0.22)	-0.030	(0.72)	0.467	
Adj R <sup>2</sup>	0.2183				PM =	
					0.367	
Likelihood Ratio Index <u>8/</u>			0.2156			
Likelihood Ratio Statistics			218.5			
# of Observations <u>9/</u>	730		731			
Correctly % Predicted	73.01		73.19.			
* t-statistic						

Notes:

1. The OLS model has a dichotomous dependent variable where "1" represents "recent movers".

2. "Yrpvdu" equals "years in previous dwelling unit".

3. "Yrjob" equals "years in present job".

4. "Migrant" represents a household head who arrived between 2 and 5 years before the survey.

5. The LOGIT model estimates

$$L(P/1-P) = XB \text{ where}$$

$L(P/1-P)$  = log of odds that an event will occur; P = probability of event;

X = independent variable vector; and B = vector of parameters.

6. LOGIT coefficients are made comparable to OLS coefficients using

$B_i P(1-P) = \frac{\partial P}{\partial x_i}$  where  $B_i$  is the LOGIT coefficient and P = probability of the variable at the mean.

7. Mean from OLS run.

8. The likelihood ratio index is equivalent to the  $R^2$  of the OLS model. The greater the value, the better the fit. A value above 0.2 is regarded as a good fit.

9. The number of observations was chosen using a random number generator.

Probability of Move < Bogota 1978 >  
Comparison of OLS and LOGIT Elasticities

	<u>OLS</u>	<u>LOGIT</u>
Income	-0.135	-0.253
Age	-1.374	-1.096
Family Size	-0.536	-0.627
YRPVDU	-0.043	-0.043
YRJOB	-0.083	-0.083
Number of Household Workers	0.230	0.094

Table II-13

Estimation of Probability of Move < Cali 1978>  
Comparison of OLS and LOGIT Estimation

	<u>OLS</u> <u>1/</u>		<u>LOGIT</u> <u>5/</u>	<u>Sample Mean</u> <u>7/</u>
Constant	1.156	*(6.90)	0.6424	(3.17)
Income	-0.005	(1.43)	-0.0056	(1.39)
Income Squared	0.00006	(1.36)	0.00006	(1.22)
Age	-0.016	(2.06)	-0.0127	(1.38)
Age Squared	0.00007	(0.96)	0.00004	(0.38)
Family Size	-0.081	(3.23)	-0.0888	(2.90)
Family Size Squared	0.005	(2.30)	0.0047	(1.90)
Sex (F=1)	-0.0007	(0.01)	0.0037	(0.05)
YRPVDU <u>2/</u>	-0.010	(3.21)	-0.0135	(3.06)
YRJOB <u>3/</u>	-0.003	(1.43)	-0.0046	(1.50)
Number of Workers	0.023	(1.23)	0.0260	(1.13)
Household Head				
Migrant <u>4/</u> (Yes=1)	0.176	(2.55)	0.2189	(2.80)
Couples (Yes=1)	0.064	(1.15)	0.0882	(1.34)
Origin Sector (3,4,5 = 1)	-0.021	(0.54)	-0.0371	(0.78)
Adj. R <sup>2</sup>	0.1400			PM = 0.357
Likelihood Ratio Index <u>8/</u>			0.1824	
Likelihood Ratio Statistics			189.7	
# of observations	742		750	
% Correctly Predicted	67.25		72.93	
* t-statistic				

Notes:

1. The OLS model has a dichotomous dependent variable where "1" represents "recent movers".
2. "Yrpvdu" equals "years in previous dwelling unit".
3. "Yrjob" equals "years in present job".
4. "Migrant" represents a household head who arrived between 2 and 5 years before the survey; more recent arrivals are denoted by Recent Migrant (1).
5. The LOGIT model estimates

$$L(P/1-P) = XB \text{ where}$$

$L(P/1-P)$  = log of odds that an event will occur;  $P$  = probability of event;  
 $X$  = independent variable vector; and  $B$  = vector of parameters,

6. LOGIT coefficients are made comparable to OLS coefficients using  
 $B_i P(1-P) = \frac{\partial P}{\partial x_i}$  where  $B_i$  is the LOGIT coefficient and  $P$  = probability of the variable at the mean.
7. Mean from OLS run.
8. The likelihood ratio index is equivalent to the  $R^2$  of the OLS model. The greater the value, the better the fit. A value above 0.2 is regarded as a good fit.

Probability of Move <Cali 1978>  
Comparison of OLS and LOGIT Elasticities

	<u>OLS</u>	<u>LOGIT</u>
Y	-0.117	-0.136
Age	-1.198	-1.110
FS	-0.439	-0.587
YRPVDU	-0.126	-0.170
YRJOB	-0.052	-0.079
Worker	0.111	0.125

The OLS and LOGIT models differ in coefficient signs across both cities in only the three instances cited (household head sex in Cali and Bogota; disadvantaged sector origin in Bogota). Furthermore, in the case of Cali, the two estimation procedures agree in labelling as insignificant the following variables: "income", "income squared", "age squared", "household head sex", "years on job", "number of workers in household" "couples" and "disadvantaged sector of origin". They disagree only on the coefficient of the variable "age", which the LOGIT procedure suggests is insignificant. For Bogota three of these variables have insignificant coefficients in both instances ("household head sex", "couples" and "disadvantaged sector of origin"). In four additional instances ("age squared", "family size squared" "years on job" and "number of workers in household") the LOGIT procedure alone yields insignificant coefficients.

All other variables are significant in both cities using both estimations. In addition, the OLS and LOGIT coefficients are similar in magnitude within and across cities, reinforcing the hypothesis that moving behavior has a set of fairly robust explanatory variables. Finally the overall explanatory power of both approaches is similar in each city in terms of variance explained and percent correctly predicted.

The variables "income", "age" and "family size" are all negatively associated with the probability of move in both cities. For Bogota both the untransformed and the second order terms associated with these variables are significant, with the exception of the LOGIT results for the square of "age" and "family size". For Cali only the family size variable, untransformed

and squared, is significant in both formulations. "Age", but not "age squared", is significant in the OLS case. Both procedures label "income" and "income squared" as having insignificant coefficients. The associated elasticities for these three variables are very similar, though the LOGIT results are usually higher. The highest elasticities are associated with "age" and range from -1.2 to -1.3 using OLS to -1.1 using LOGIT. Family size elasticities are smaller, varying between -0.4 and -0.5 for OLS to -0.6, using LOGIT. The income elasticities vary from -0.1 to -0.2 across both cities.

Among the remaining continuous variables, the measures of stability, including "years in present job" and "years lived in previous dwelling" are negatively associated with the probability of moving, though the elasticities are all small (-0.1 or below). In Bogota only the OLS estimate of the "jobs" coefficient is significant; in Cali only the two "previous dwelling" coefficients are significant. The remaining continuous variable, "workers in household", is significant only in the Cali case, though in all instances the elasticities are low and have values of approximately -0.1.

Of the remaining dummy variables, only one is significant: the one that separates recent migrant household heads from the rest. Households with a short history of residence in either city are likely to be more mobile than their counterparts. The associated slope shift is higher for the LOGIT versions (50% in Bogota; 34% in Cali) than for the OLS ones (12% in Bogota and 15% in Cali).

One can deduce from the above that the cross-tabular results are generally sturdy indicators. Furthermore the OLS and LOGIT versions produce coefficient with the same signs in most instances, though the LOGIT formulation tends to generate somewhat larger coefficients. The LOGIT version is also somewhat more likely to label a variable insignificant than the OLS version. Nevertheless, as a first approximation it is clear that the OLS model is not discredited when compared to the LOGIT results.

In addition one can conclude that the results for Bogota and Cali are generally alike, even though they are cities of quite different sizes. This corresponds to the findings based on cross-tabulations, which again emphasize similarities rather than differences.

Summary

For Cali and Bogota, rates of residential relocation are high and similar. Approximately 23 percent of all households moved within one year prior to the surveys; in less than four years, half of the households relocated.

The direction of the impact of each independent variable on the probability of move, drawn from the cross-tabulations, is confirmed by the OLS and LOGIT estimations. Generally the coefficients are quite similar for both formulations and for each city. The LOGIT estimates are less likely to be significant.

The evidence suggests that lower income households move more often, as do households headed by young household heads. Independently of this, smaller households are more likely to move than larger ones; this reinforces the age effects, since most small households have relatively young household heads. Of the remaining variables only one has a sizeable and significant impact on mobility: households headed by recent migrants are more likely to be mobile than their native or more experienced counterparts.

As a rule, the cross-tabulations prove to be sturdy predictors of behavior. Furthermore the OLS estimates, which are easier and cheaper to generate, are confirmed by the more sophisticated LOGIT techniques.

### SECTION III: FACTORS AFFECTING RELOCATION BEHAVIOR

#### Patterns of Relocation by Concentric Zone

If recent mover relocation from the immediate past residence to the present residence is analyzed at the level of rings and sectors certain patterns emerge. <sup>1/</sup>

The relevant information can be summarized by ring. Several conclusions can be deduced for Bogota. First, there is a pattern of decentralization at work in Bogota 1972 which is no longer as evident in Bogota 1978. The first three rings, for example, contain about 28% of the previous residences and 23% of the present residences in 1972. The 1978 data suggest differences in origins from and destinations to the first three rings have narrowed, to 24% and 22%.

This finding, based on household behavior, does not continuing population shifts, especially if the sizes of households originating in the central rings exceed that of those destined to those rings to a sufficient degree. Nevertheless, as Table III-1 reveals, population shifts to the periphery by recent movers are evident only in

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1/ The same analysis can be repeated for non-movers, using past and present residence zone, and present work zone. The results are not noticeably different from those presented below.

TABLE III-1

Mover Population, Mover Household Size, and  
Decentralization

A. Bogota, 1972 (Movers 1971-1972)

	<u>Origin</u>		<u>Destination</u>	
	Household Size	Population	Household Size	Population
Ring 1	4.2	21,456	4.2	13,623
2	5.0	91,785	4.6	74,543
3	5.1	115,917	4.9	90,680
4	5.0	227,481	5.0	278,681
5	5.3	215,134	5.1	330,726
6	5.6	7,923	5.0	18,631
Other	4.6	126,559		
Total	5.0	806,255	5.0	806,884

B. Bogota, 1978 (Movers Within Previous Year)

	<u>Origin</u>		<u>Destination</u>	
	Household Size	Population	Household Size	Population
Ring 1	3.2	15,293	3.3	15,057
2	4.0	59,900	3.6	62,909
3	3.6	59,910	3.6	57,835
4	4.1	151,294	3.9	193,611
5	4.4	249,889	4.7	293,020
6	4.5	23,101	4.0	31,320
Other	4.0	94,768		
Total	4.1	654,155	4.1	653,752

C. Cali, 1978 (Movers Within Previous Year)

	<u>Origin</u>		<u>Destination</u>	
	Household Size	Population	Household Size	Population
Ring 1	4.7	6,308	2.4	3,010
2	3.9	36,726	3.8	39,209
3	4.2	77,371	4.2	90,177
4	4.4	49,799	4.5	57,346
5	3.5	6,568	3.2	10,049
Other	3.4	23,011		
Total	4.2	199,783	4.1	199,791

the 1972 data, when 28% of the person origins and only 22% of the destinations were located in the first three rings. For 1978, both Cali and Bogota, there is no evidence of population decentralizing from the inner rings to the periphery, among recent movers. Twenty percent of the Bogota person origins and the person destinations in that year were located in the three inner rings; in Cali, the relevant proportions for the first two rings are 21% of the origins and 21% of the destinations. Thus the person movement data reinforce the household movement information discussed above, even though the size of the inner ring incoming households is not larger, and is often smaller, than that of the outgoing households.

Second, excluding the rather eccentric behavior of Ring 6, a lightly populated area just undergoing the transition from rural to urban development, reverse residential migration back toward the center is the exception. As Table III-2 demonstrates, the highest rate of reverse residential migration in the remaining rings is approximately 25%. This is the case for both 1972 and 1978. <sup>2/</sup>

Third, a majority of all moves occurs within the ring of origin when the city is taken as a whole. There are variations by ring of origin. In 1972 and 1978, Rings 4 and 5, which are the poorest and the most populous rings, have "retention" rates of 55% to 75%. These are clearly higher than for any other ring in 1972, where the next

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2/ By definition Ring 1 can have no reverse residential migration.

Table III-2

Present Residence Compared with Previous Residence by  
Ring - Recent Mover Households

A. Bogota, 1972

Move Type	Moved Within Same Ring	Moved to Ring Farther From Center	Moved to Ring Closer to Center
Ring			
Ring 1	35%	65%	N.A.
2	36%	62%	2%
3	28%	56%	16%
4	59%	29%	12%
5	73%	1%	26%
6	18%	N.A.	82%
Total	53%	31%	16%

B. Bogota, 1978

Move Type	Moved Within Same Ring	Moved to Ring Farther From Center	Moved to Ring Closer to Center
Ring			
Ring 1	17%	83%	N.A.
2	58%	30%	12%
3	35%	43%	22%
4	55%	23%	22%
5	74%	2%	24%
6	46%	N.A.	54%
Total	59%	18%	23%

C. Cali, 1978

Move Type	Moved Within Same Ring	Moved to Ring Farther from Center	Moved to Ring Closer to Center
Ring			
Ring 1	41%	59%	N.A.
2	67%	33%	5%
3	73%	14%	13%
4	61%	3%	36%
5	39%	N.A.	61%
Total	64%	19%	17%

highest level is 36% (Ring 2); they are higher, as well, though in a less dramatic way, in 1978, because Ring 2 retention rates reach 58%.

Can we conclude anything about these patterns? Though doubt has previously been cast on the validity of the 1972 data that assigned one-quarter of all jobs to the core, we can safely assume, from information presented in Section I, that employment is decentralizing in Bogota. Other work by Kyu Sik Lee, on the behavior of the manufacturing sector, suggests the same conclusions.<sup>3/</sup> We also know that, at any given point in time, there is a tendency for land values to decline quite sharply from the center to the periphery.

One plausible scenario assumes that non-population serving sources of employment (manufacturing, wholesaling, certain office-type functions) have found it possible to relocate to or to expand at peripheral sites, cutting down on the costs of land acquisition by buying tracts of undeveloped land. Household decision-makers working at those sites must consider, among others, two major factors in deciding on their residential location: commuting costs (including time spent travelling) and housing costs. When jobs are highly centralized, this presents households with a significant trade-off between accessibility and low

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3/ See, for example, Intra-Urban Location of Manufacturing Employment in Colombia, Washington, D.C., Urban and Regional Report No. 79-10, World Bank, August 1979.

4/ See R. Mohan and R. Villamizar, The Evolution of Land Values in the Context of Rapid Urban Growth: A Case Study of Bogota and Cali, Washington, D.C., Urban and Regional Report No. 80-10, World Bank, October 1980.

housing costs. Once non-population serving jobs disperse, the trade-off becomes less severe, for households can both locate close to their jobs and take advantage of low cost land. This becomes all the more attractive when note is taken of the fact that unserviced, low-cost land in the periphery is ideal for households who want to become homeowners by building a house in stages, using unpaid as well as paid construction labor. Since such homeowners turn out to be important providers of rental rooms, their behavior influences even those households who have limited means and must find rental space. Finally this dislocation of households means a simultaneous outward flow of purchasing power, luring population-serving jobs toward the periphery, often into the very houses being constructed in stages. 5/

All these factors suggest plausible grounds for decentralization and for relatively low levels of reverse commuting, from residences closer to the C.B.D. than the employment sites. 6/

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- 5/ Clearly the assumption that employment and residential locations are inter-linked does not assume causality runs only in one direction. Households may be guided by the location of jobs or may search for jobs given the residence location. The latter may be especially plausible for secondary household workers.
  - 6/ The discussion implicitly assumes that household head job locations are the critical employment-related variable. Later analyses in this section concentrates on the behavior of the household head. It is possible that as other members add to the household income, decisions become more diffuse. The 1978 survey allows one to conclude that households where the head contributes less than 50% of all income amount to only 25% of those in Bogota and Cali. The ring or sector distribution of residences for households working in any given ring or sector does not differ appreciably by whether or not multiple workers are present.

The Issue of Locational Disadvantage

What can be said about the differing rates of movement as between and within rings? The answer is, very little. The rings (as well as the sectors) are artificial constructs, convenient forms of aggregating neighborhoods. In a rough way each succeeding ring is simply a strip of land further away from the CBD, but cutting across a variety of types of residential areas. If one excludes Rings 1 and 6 because of their relatively insignificant population, the ratio of the lowest ring median income to the highest is 48% in 1972 and fully 69% in 1978, when the personal income coverage is considerably higher than in the earlier survey. By contrast, the median income ratio of the poorest to the richest sector (again excluding Sector 1) is 21% in 1972 and 24% in 1978. Looking especially at the 1978 data, it appears that rings are heterogeneous enough within themselves so as to be of limited use as a basis for re-examining the hypothesis that household relocation flexibility may be geographically determined. Furthermore the very meaning of the dichotomy implied by dividing moves between and within rings, is open to serious question when Rings 4 and 5 are so vast in size compared to Rings 1, 2, and 3.<sup>7/</sup> The possibilities of multiple alternative locations for residence choice are far greater in Rings 4 and 5 than in the first three rings. It is therefore not particularly surprising that retention rates bear some association to the area of the ring of origin. Finally since the bulk of jobs (especially in the more plausible 1978 data) and of population are located in Rings 4 and 5 and

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<sup>7/</sup> These two rings contain 20% and 47%, respectively, of Bogota's land area. The first three rings, combined, contain only 13% of the land area.

since these areas are favored by the relative abundance of low cost urban land, one need only assume that households trying to economize both on the information costs of searching for a new residence and on finding housing "bargains" that combine low cost land and good access to jobs, would tend to favor those two peripheral rings. These attractive features of Rings 4 and 5 are confirmed by noticing that, when households move out of other rings they tend to favor Rings 4 and 5 as their zones of destination, especially in 1972. To read more into the retention rate differences by ring therefore appears inadvisable. <sup>8/</sup>

Much the same conclusions apply to Cali. A very mild degree of residential decentralization is apparent from the 1978 data, from Rings 1 and 2 to Rings 3, 4 and 5. Twenty-two percent of the household moves originate in the first two zones and 23% terminate there. Since Ring 3 contains 37% of the origins and 43% of the destinations, and since Ring 4 accounts for 22% of the origins and 25% of the destinations, it is clear that the periphery is as well established as a residential area in Cali as it is in Bogota. While jobs are somewhat more tightly clustered in Cali than in Bogota, half of all employment is located in Rings 3 and 4, again suggesting the existence of the type of phenomenon already reviewed in the Bogota case.

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8/ Significantly, the tests of locational disadvantage reviewed by Rakesh Mohan dwell on sectors not rings. See The People of Bogota: Who They Are, What They Earn, Where They Live, Washington D.C., World Bank Staff Working Paper # 390, May 1980.

As Table III-2 demonstrates, reverse migration in Cali is rare except for the less developed outer fringe (Ring 5). For Rings 2, 3 and 4 the rate of reverse commuting is 5%, 13% and 36%; for Ring 5 it is 61% but most of this is destined for Rings 3 and 4 and hardly constitutes a "back to the center" movement.

Like Bogota, and if Ring 1 is excluded both because of its small size and infinitesimal population, the ring retention rates for movers in Cali hover around a fairly wide band that ranges from 39% to 67%, for a citywide average, including Ring 1, of 64%. As in the case of Bogota, the rings are of unequal size, though the variation is slightly less pronounced.<sup>9/</sup> Excluding Ring 1, the ratio of the median income of the poorest to the richest ring is 72%, implying an even greater obliteration of heterogeneity in the process of aggregation than was found to be the case in Bogota. Cali thus presents an even less promising ground for examining the explanatory power of a locational disadvantage hypothesis by analyzing moving behavior within and between rings.

#### Patterns of Relocation by Radial Sector

Table III-3 summarizes the relocation behavior of recent movers by sector. Again several conclusions can be drawn from the data. With the exception of Sector 1 (the CBD), a majority or near majority of all relocators in Bogota 1972 stayed within their sector of origin, with

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<sup>9/</sup> Rings 3 and 4 each contain 33% of the area, while Rings 2 and 5 each include 16% of the area. By contrast Ring 5 in Bogota encloses 47% of the city's land area and Rings 2 and 3, combined, contain only 12%.

Table III-3

Present Residence Compared with Previous Residence  
by Sector - Recent Mover Households

A. Bogota 1972

Move Type	Moved Within Sector of Origin	Moved to Other Sector
<b>Sector</b>		
1	35%	65%
2	57%	43%
3	64%	36%
4	55%	54%
5	45%	55%
6	68%	32%
7	45%	55%
8	46%	54%
<b>Total</b>	<b>56%</b>	<b>44%</b>

B. Bogota 1978

Move Type	Moved Within Sector of Origin	Moved to Other Sector
<b>Sector</b>		
1	17%	83%
2	58%	42%
3	69%	31%
4	55%	45%
5	46%	55%
6	78%	22%
7	34%	66%
8	51%	49%
<b>Total</b>	<b>58%</b>	<b>42%</b>

C. Cali 1978

Move Type	Moved Within Sector of Origin	Moved to Other Sector
<b>Sector</b>		
1	41%	59%
2	57%	43%
3	59%	41%
4	65%	35%
5	76%	24%
6	69%	31%
7	-	100%
<b>Total</b>	<b>66%</b>	<b>34%</b>

rates varying between 45% to 68%, which represents a relatively tight cluster around the citywide average of 56%. <sup>10/</sup> Again, excepting Sector 1, the conclusions for Bogota 1978 are roughly the same. The citywide sector retention rate is 58% and all but one sector have retention rates that fall between 46% and 78%.

The exception is the small Sector 7, with a "outlier" retention rate of 34%. It should be noted that, while for some sectors the retention rates are virtually unchanged (Sectors 2, 3, 5, 8), for others, like Sectors 1, 4, 6, and 7 the rates rise or fall over time.

In Cali 1978, the average sector retention rate is 66%, which does not differ very greatly from the rate recorded for Bogota in that year. As before, most individual sector retention rates, excluding Sector 1, fall into a narrow band; in this case, varying between 57% and 76%. The only exception is the small Sector 7, whose retention rate is zero.

What could explain the high retention rates found in most sectors outside the CBD? These sectors, though artifices created for the convenience of analysis, represent a more homogeneous grouping of neighborhoods than do the previously discussed rings. Furthermore, the enormous disparities in area apparent in the ring analysis are less

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<sup>10/</sup> Clearly, the significance of the variation in rates is a matter of judgment. The retention rates vary within a band that is approximately 20% above and below the citywide average. Each analyst must decide whether this appears to be "normal" or "excessive".

severe when sectors are considered. In Bogota, excluding Sector 1, the range of sizes varies between 6% of the total area to 19%, with 5 sectors exceeding 14% of the city's land. In Cali, excluding Sector 1, the range is wider, varying from 5% to 34% of the land area; only Sector 7 falls below 11%.

The sectoral homogeneity argument refers in particular to the fact that Sectors 7 and 8 in Bogota (the former only in 1972) and Sectors 2 and 7 in Cali appear to be havens for the better-off households. In each case the mean and median sector income and the proportion of the sector households earning more than the median income clearly exceeds that of the city as a whole. Other sectors have a mix of income groups in residence, resulting in areas that are quite poor and others that are fairly average in their mean income, median income, and income distribution characteristics.

#### The Locational Disadvantage Hypothesis Revisited

One hypothesis would go further and claim it is the poor who are bound up in ghettos, and that they are thus locationally disadvantaged. Figure III-1 suggests that it is the high income households that seek out geographic exclusivity. That juxtaposes the distribution across all sectors of all households, with the pattern for all poor households and for all rich households. The poor households earn less than half the citywide median income in each case and account for roughly the bottom two deciles of the households. For the sake of symmetry, the rich households

Figure III-1a

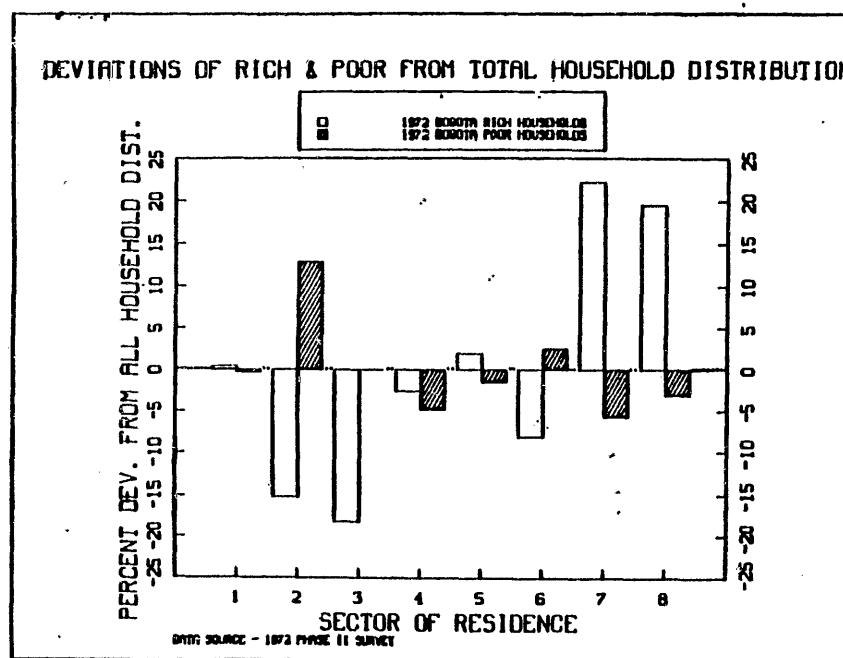
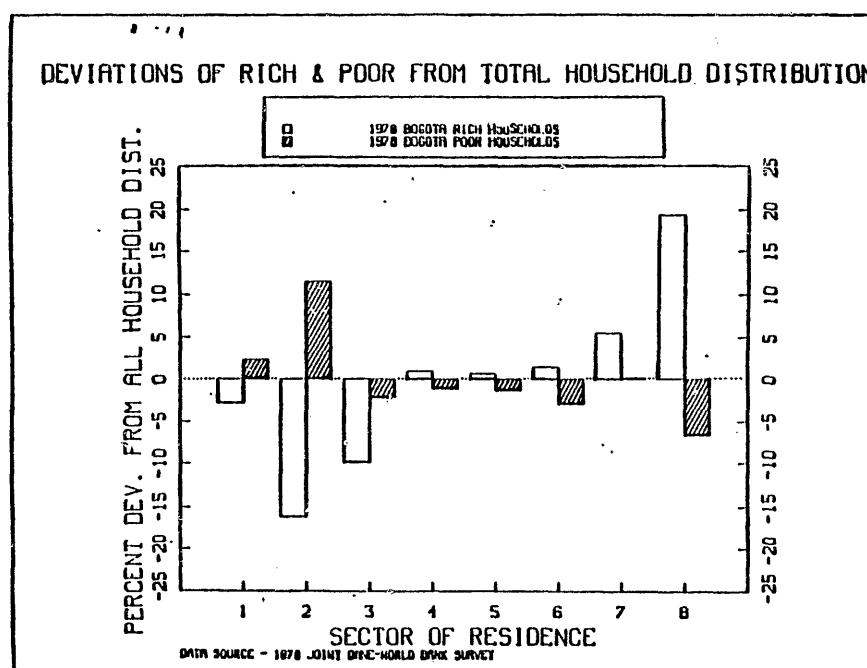
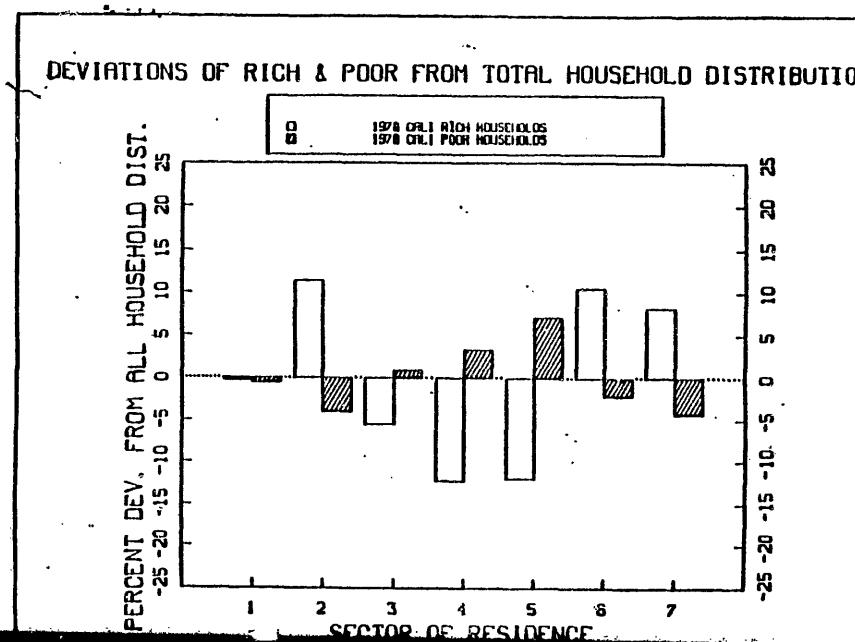


Figure III-1b



- 83 -

Figure III-1c



represent the top two deciles in each case. 11/

In 1972, Bogota's poor tended to be markedly over-represented only in Sector 2; 31.5% of the poorer households lived there compared to roughly 19% for all households. In other sectors the deviation by poorer households from the pattern established by households in general is small. Among the richer households there are important deviations from the overall mean in Sector 2 and 3, where the rich are severely under-represented, as well as in Sectors 7 and 8, where the rich are vastly over-represented. If one were to choose between the poor or the rich as guides to the distribution, across all sectors, of all households, the pattern set by the poor would be more accurate than that of the rich.

In 1978, Bogota's poor were distributed very much as the population as a whole. Of the total households identified as poor, 58% lived in Sectors 3, 4, 5, 6, 7 and did so in proportions which were between 80% and 100% of the rates expected if they were to match exactly the distribution for all households. Thirty-seven percent of the poor lived in sectors (1, 2) where their proportions exceeded that of all households taken as a whole; in the crucial sector 2, where 32% of the poor lived, the degree of over-representation was 56%, i.e., the number

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11/ This is not possible using the 1972 data, where only intervals are provided for income levels. The closest approximation is an income interval of over 5000 pesos per month, which captures 14% of the richer households as opposed to 21% for the poverty standard used. The fit is better in 1978, where roughly 20% of the poor and the rich households are compared in Cali and where the top 2 deciles of the Bogota households are compared with 24% of the poorer households.

of poor households in sector 2 is 56% greater than that expected on the basis of the distribution of all households. The poor were noticeably under-represented only in Sector 8, where their proportional share was 44% of the "all households" category. For the sake of perspective, that same Sector 8 contained only 13% of the households and 18% of the jobs in Bogota. Thus the poor were clearly under-represented in just one small part of Bogota, whether residences or jobs are used as a benchmark of the importance of Sector 8.

The Cali data generally confirm the patterns found in Bogota. The poor were distributed by sector in patterns similar to those of the population as a whole (i.e., within 20%) in Sectors 3, 4, 5, and 6, where 87% of the population lived. They were markedly under-represented only in the well-to-do sectors 2 and 7, where their numbers were only about one-fourth of that expected, given the distribution patterns of all households. It is the "rich" who deviate markedly in the locational profile. In sectors 1, 3, and 5 the better off households were represented in proportions that are 67%-85% of that expected from the aggregate data. They were severely under-represented only in Sector 4, with only one-third of the expected household total. They were over-represented in Sectors 2, 6, and 7, where the rich were found in proportions that exceed the pattern established by all households by a factor of two to three. The concentration is most marked in Sectors 2 and 7, where 11% of the population, but 31% of the rich, could be found. Again, if segregation is at work, it appears to be the self-segregation of the rich. Since

Sectors 2 and 7 contained only 16% of all Cali jobs, it is hard to argue that exclusion from those sectors constitutes a heavy liability for the working poor.

The locational disadvantage hypothesis is thus not very satisfying especially as a single explanation for moving behavior. What can be said with certainty is that the higher retention rates (Sectors 3 and 6 in Bogota 1972; Sector 3 in Bogota 1978; and Sectors 4 and 5 in Cali 1978) generally occur in sectors that are relatively poor. On the other hand, high retention rates are found in non-poor sectors (Sector 6 in Bogota 1978). Furthermore poor and rich sectors can have very similar retention rates (Sector 2 and 8 in Bogota 1978; and Sectors 2 and 3 in Cali 1978).

Table III-4 presents the results of Robert Corno's longitudinal survey of adult native Bogotanos and of adult migrants who arrived in Bogota between 1932 and 1969. The sector of birth or of arrival is contrasted with that of 1975 residence, testing the possibility of long-term confinement to one sector. Among migrants and natives only one sector, Sector 6, shows very high long-run retention rates (91% for natives and 77% for migrants). For other sectors the results are quite different. In no case do more than 33% of the migrants remain in the sector of arrival. Among natives the rates of retention are slightly in excess of 50% for the small Sector 1 and for Sector 2. The retention rate for those born

Table III-4

Sector of Birth/Arrival Versus Present Zone

A. Natives

	<u>Origin</u>	<u>Destination</u>	<u>Remain in Same Sector</u>
Sector 1	5%	3%	55%
2	23%	26%	53%
3	19%	30%	23%
4	14%	5%	-
5	8%	6%	30%
6	9%	14%	91%
7	9%	10%	28%
8	12%	6%	32%

B. Migrants Who Arrived Between 1932-1969

Sector 1	6%	-	7%
2	14%	18%	33%
3	24%	23%	33%
4	8%	13%	18%
5	9%	10%	32%
6	10%	20%	77%
7	20%	9%	7%
8	9%	4%	16%

in Sector 3, for example, is only 23%, lower than that for Sector 7 or Sector 8. It is clear that over the long-run, retention rates are typically well below those detected when the origin and destination of only one move are traced. The key to reconciling the different sets of data is the fact that, across the city, a substantial proportion of all households move in any given year. Even in the most "self-contained" sectors, there is "leakage" to other parts of the city. Thus, over time, it would not be surprising to find relatively low retention rates for most sectors.

Instead of concentrating on the variation in retention rates, and the fact that there are cases where high retention rates are linked to poor sectors, would it not be more useful to explore why short-run retention rates exceed 44% in all but 4 cases? With that shift in perspective one does have access to alternate and quite plausible hypotheses. Furthermore one then does not face the necessity of disposing of other data which clearly suggest that socio-economic characteristics help to determine residential sector location and not that geography determines one's economic fate. Elaborate demonstrations that the returns to greater education and/or work experience have "flatter" profiles in predominantly poor sectors prove little because a statistical fallacy is involved: in those sectors one truncates the variation of the dependent variable by looking at only observations of predominantly poor or intermediate income households (a common case for several sectors when used as units of observation). In those areas, it follows, by definition, that

independent variables like "years of education" and "years on the job" will not perform as well as in cases where the unit of observation is a sector with abundant representation of "successful" households defined in terms of income. Where truncation is not likely to be a problem, as for example, in measuring the returns to workers with only primary education (who are not likely to earn high enough incomes to be excluded from any sector), the results are predictable: the returns to education show no discernible variation by sector of residence. <sup>12/</sup>

#### Inter-Area Movements: An Alternate Hypothesis

The most satisfying alternate hypothesis is that households match their income and assets to zonal amenities, to considerations of access to the type of employment for which the household head is qualified, and to the cost/availability of different bundles of housing services.

This hypothesis has some independent corroboration. Figures III-2, III-3, and III-4 juxtapose, by ring and then by sector, the location of previous residence, present residence, and present employment. All of this data yield a clearly discernible pattern: households locate in such a way that they favor their zone of employment of the household head and do so more clearly as one considers locations farther from the CBD. In line with this, one notices that present residences are closer to household head job locations than previous residences. As already noted, the further hypothesis that households relocate in response to changes in job locations or alternatively that households change job locations in response to new residential locations,

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12/ This is particularly clear in Rakesh Mohan The People of Bogota: Who They Are, What They Earn, Where They Live, op.cit., p. 87, Figure 3B, where the income derived from primary education is very similar for all sectors of origin except Sector 4. The "gap" in returns is significant only for those with secondary and higher education, where truncation is a binding constraint.

Figure III-2a

BOGOTA 1972

HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN RING 1

■—■ FOR PRESENT RESIDENCE  
●—● FOR PREVIOUS RESIDENCE

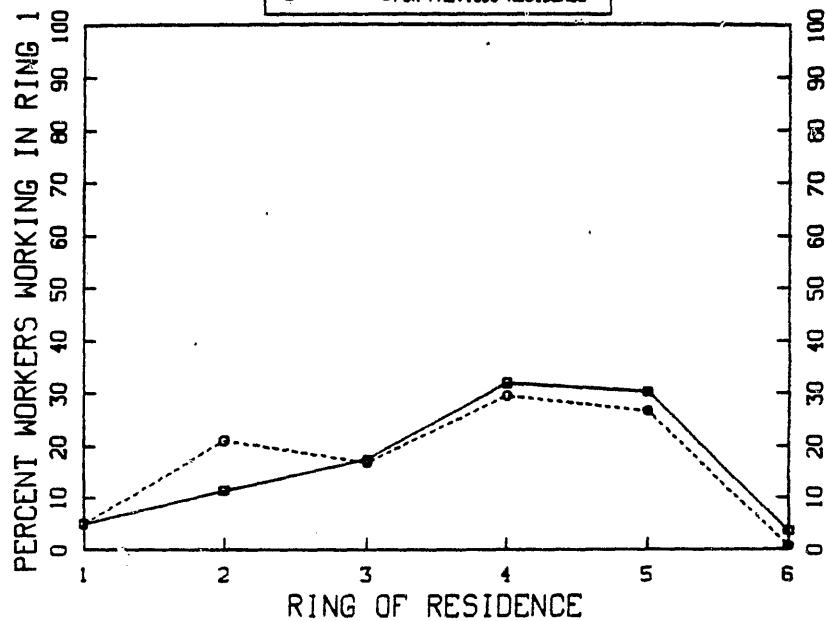


Figure III-2b

BOGOTA 1972

HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN RING 2

■—■ FOR PRESENT RESIDENCE  
●—● FOR PREVIOUS RESIDENCE

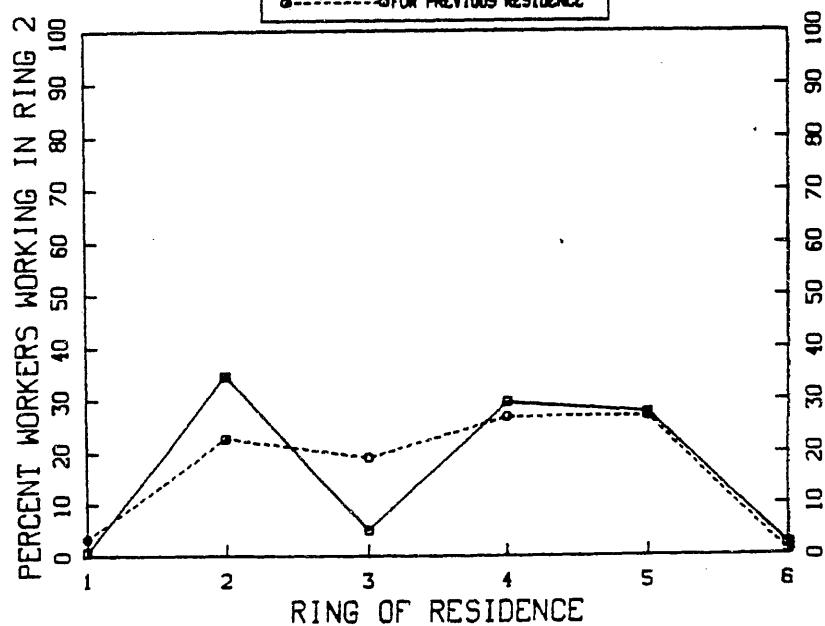


Figure III-2a

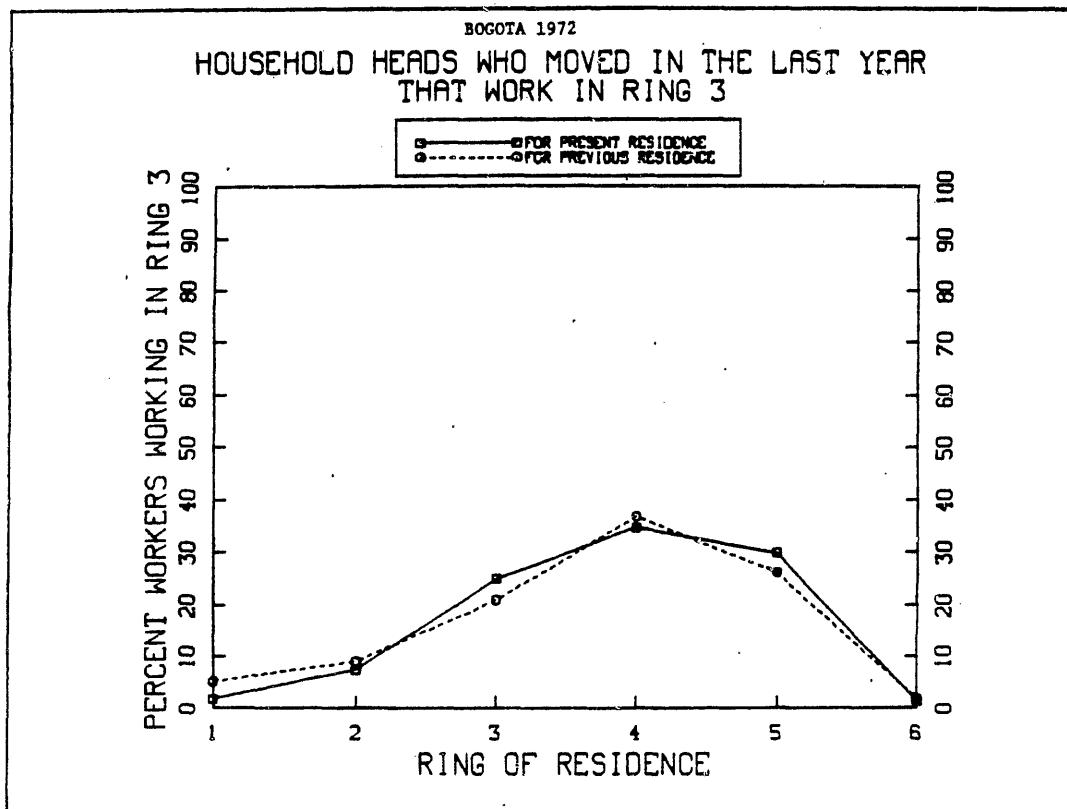
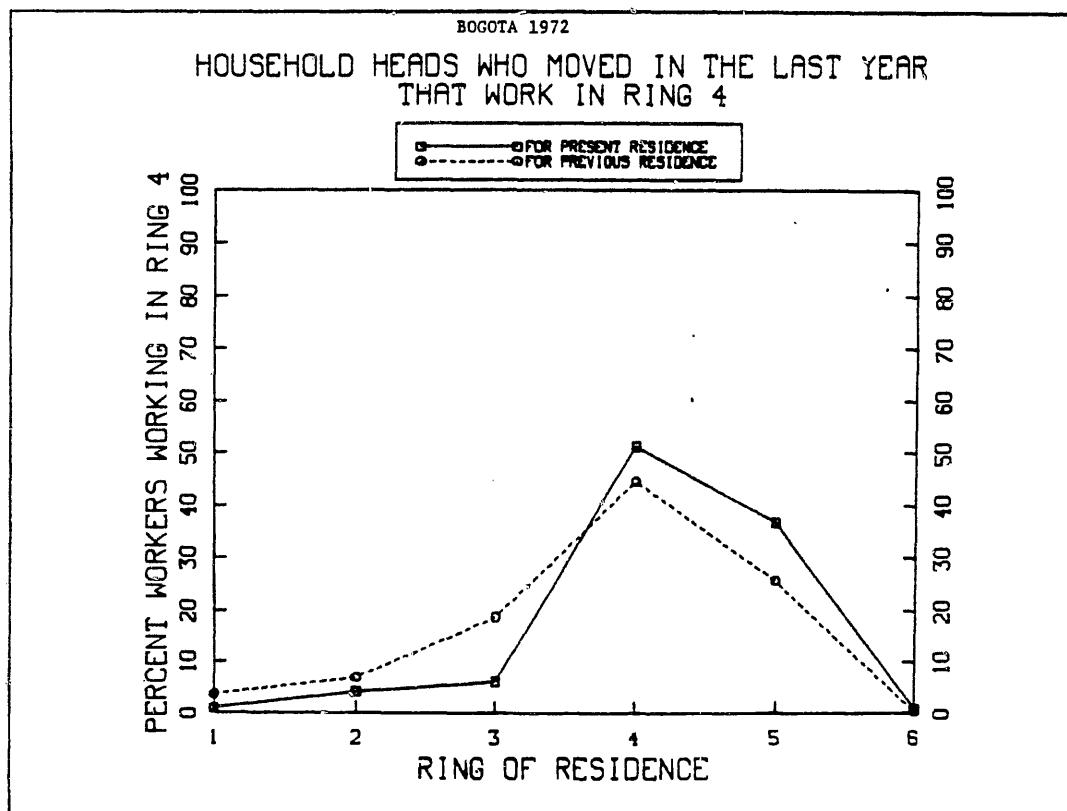


Figure III-2a



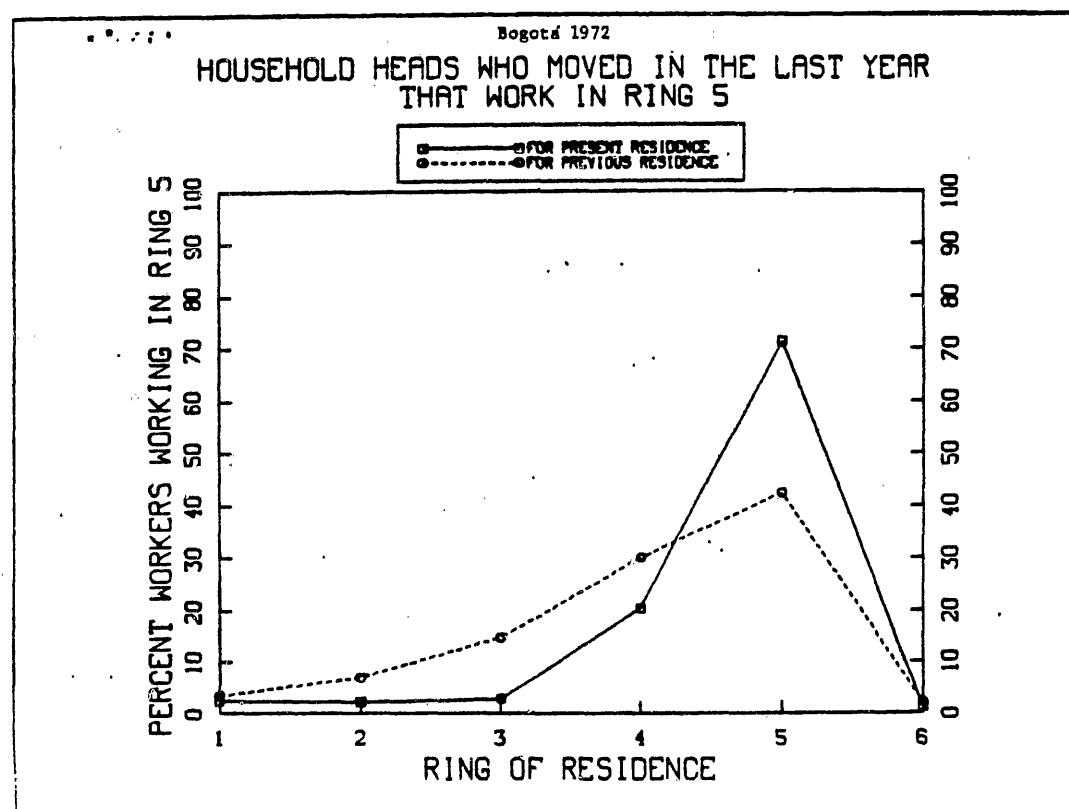


Figure III-2a

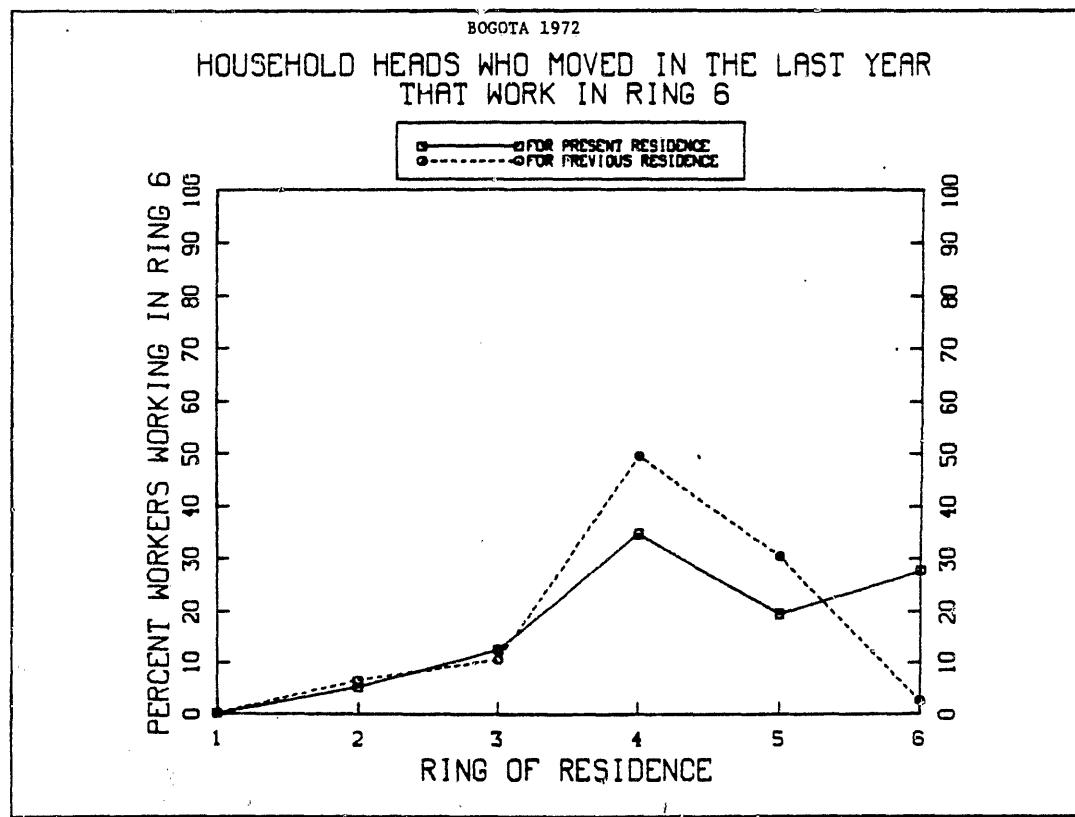


Figure III-2b

BOGOTA 1972  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 1.

— FOR PRESENT RESIDENCE  
— FOR PREVIOUS RESIDENCE

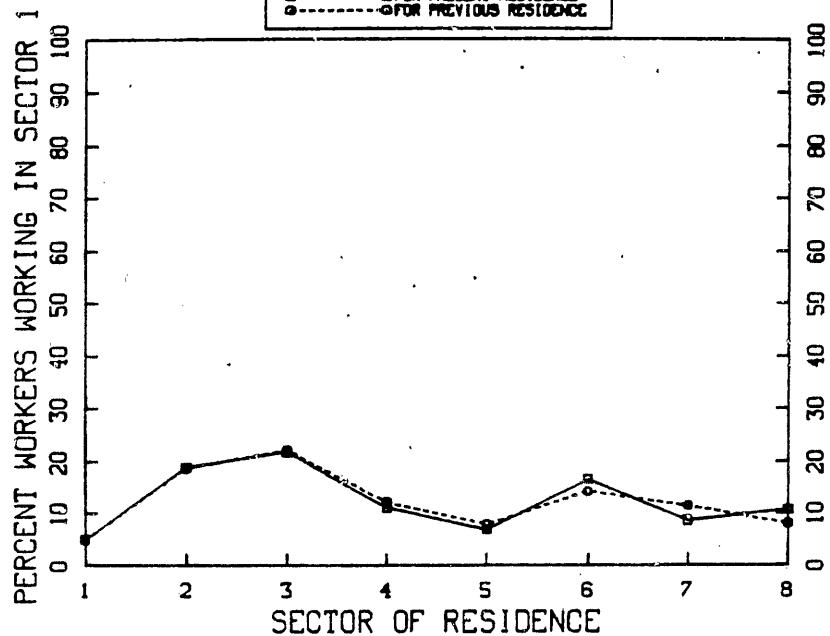


Figure III-2b

Bogota 1972  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 2

— FOR PRESENT RESIDENCE  
— FOR PREVIOUS RESIDENCE

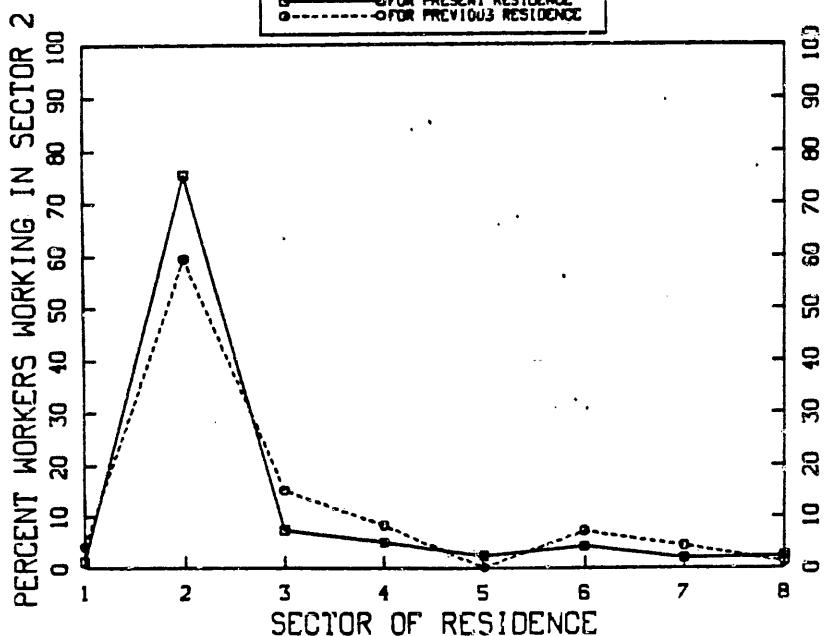


Figure III-2b

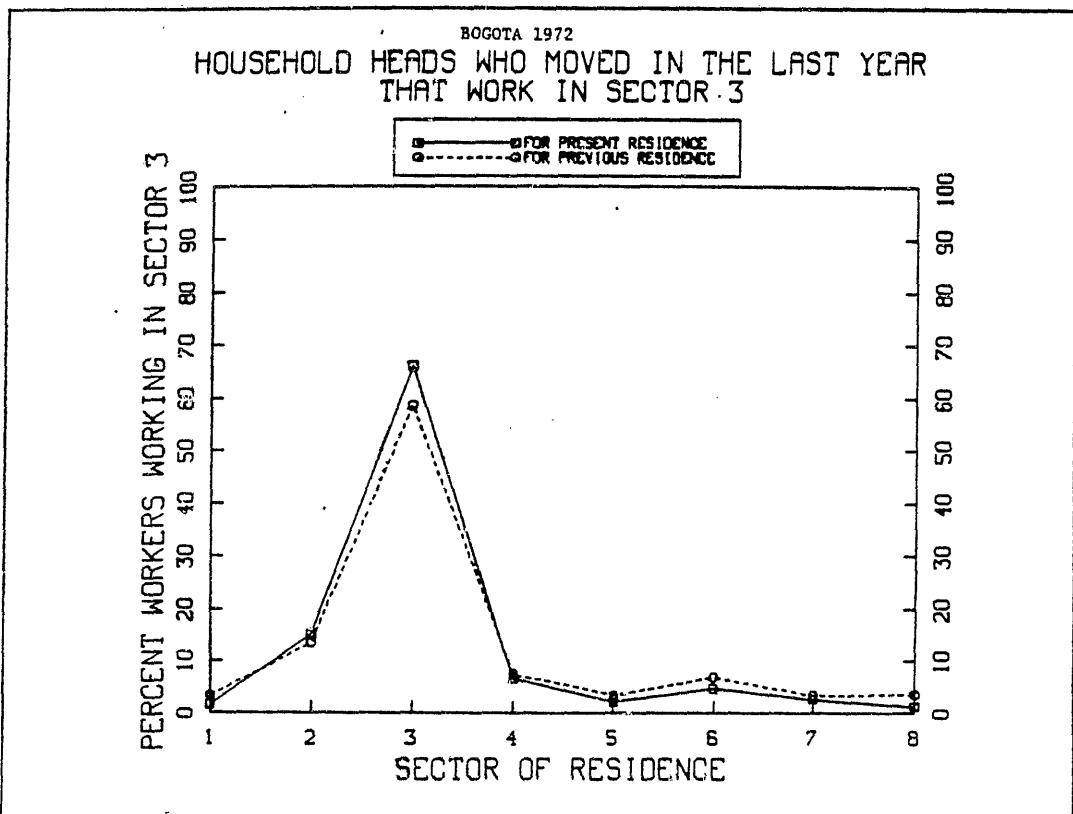


Figure III-2b

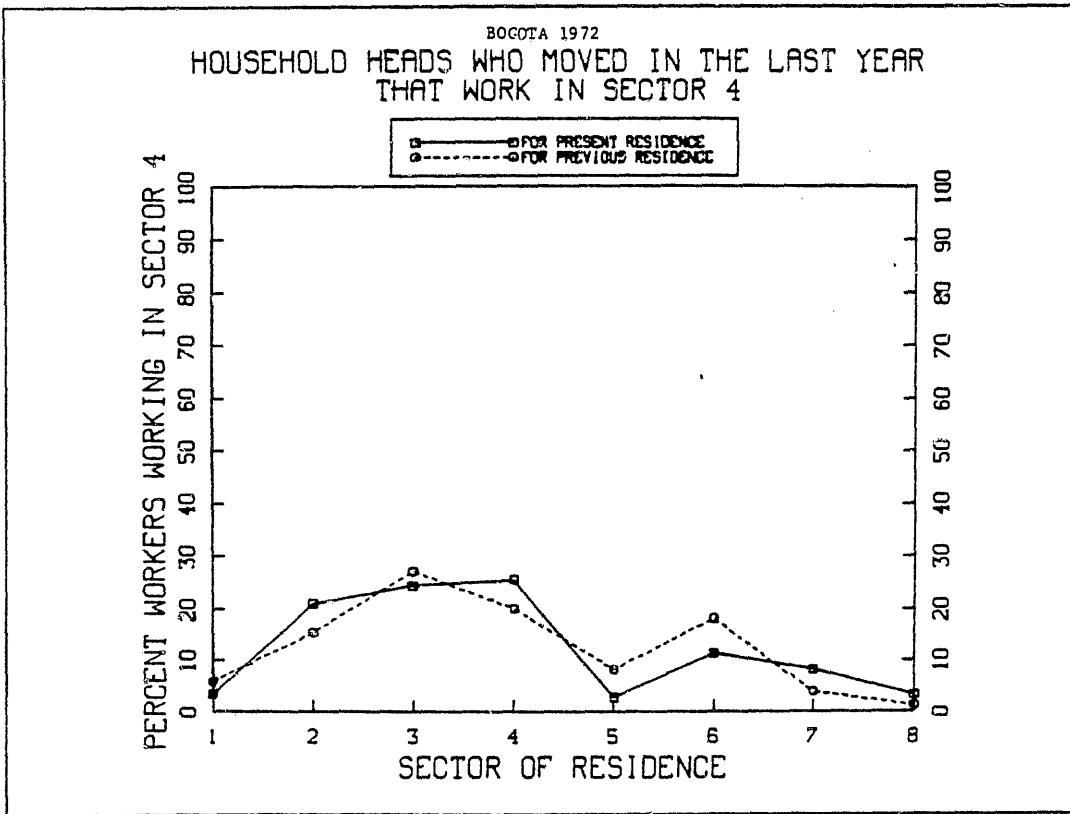


Figure III-2b

BOGOTA 1972  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 5

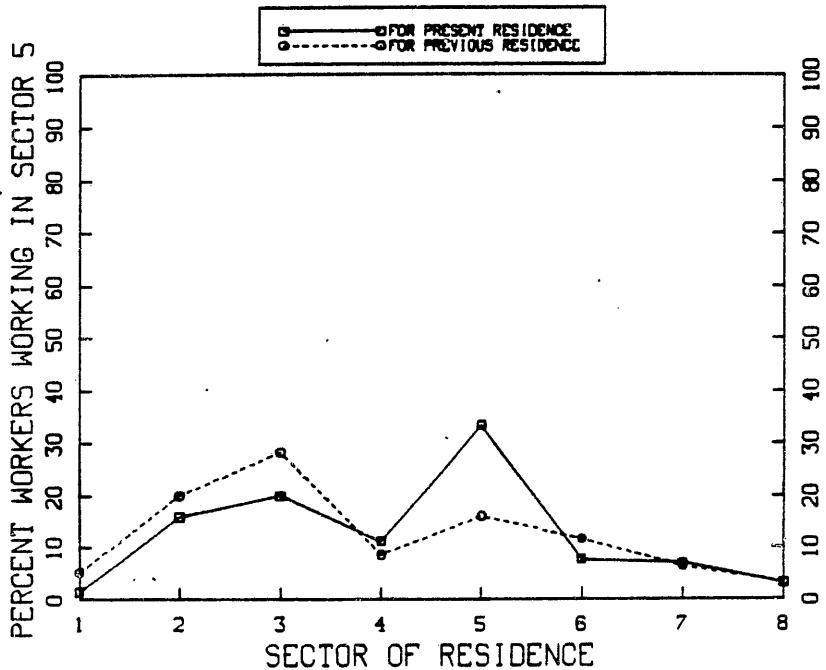


Figure III-2b

BOGOTA 1972  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 6

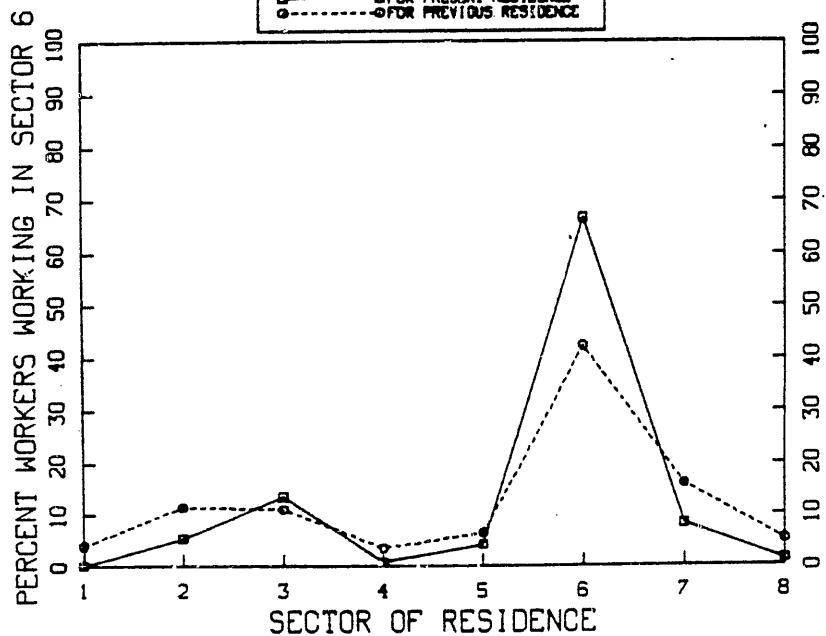


Figure III-2b

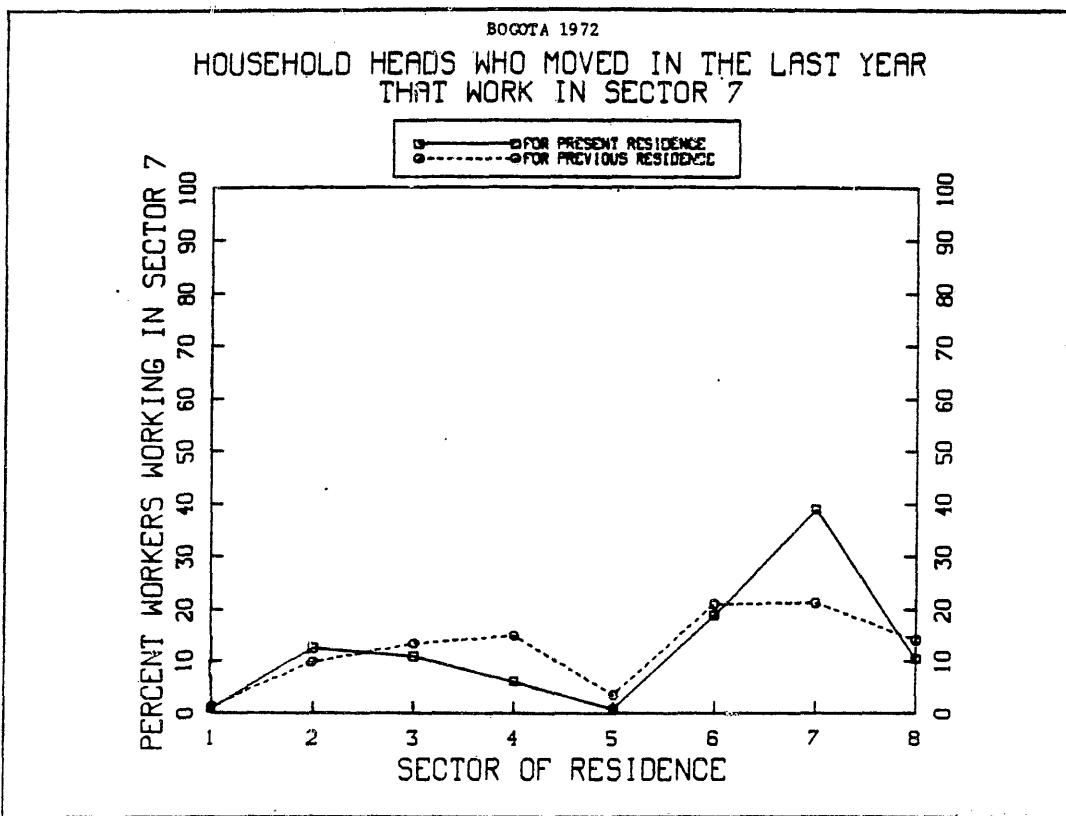


Figure III-2b

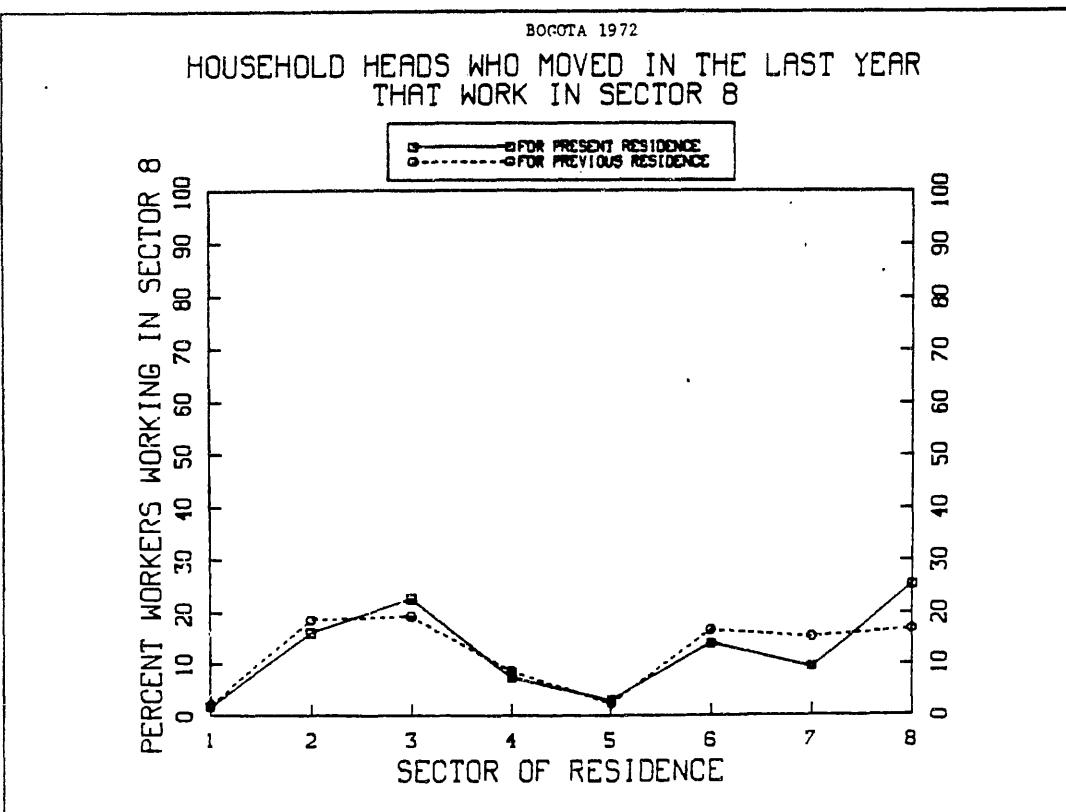


Figure III-3a

**HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN RING 1**

BOGOTA 1978

■ PRESENT RESIDENCE  
— PREVIOUS RESIDENCE

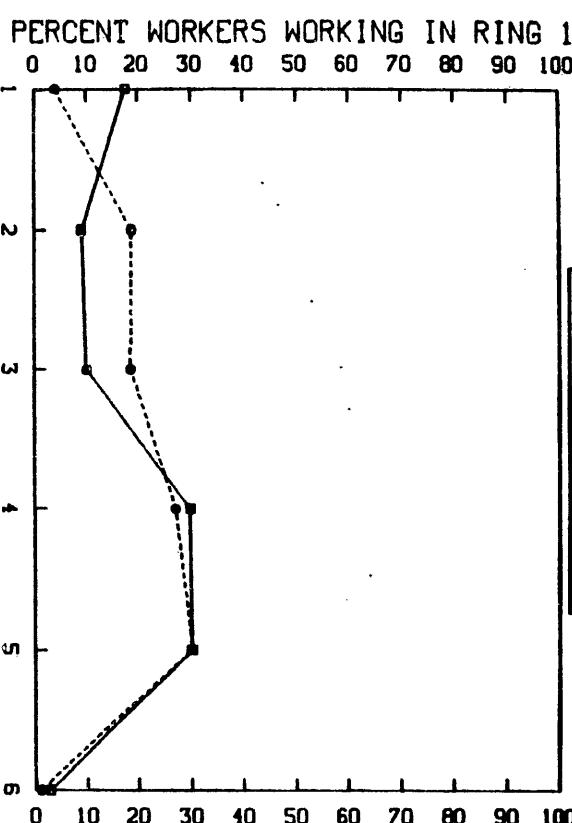


Figure III-3a

**HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN RING 2**

BOGOTA 1978

■ PRESENT RESIDENCE  
— PREVIOUS RESIDENCE

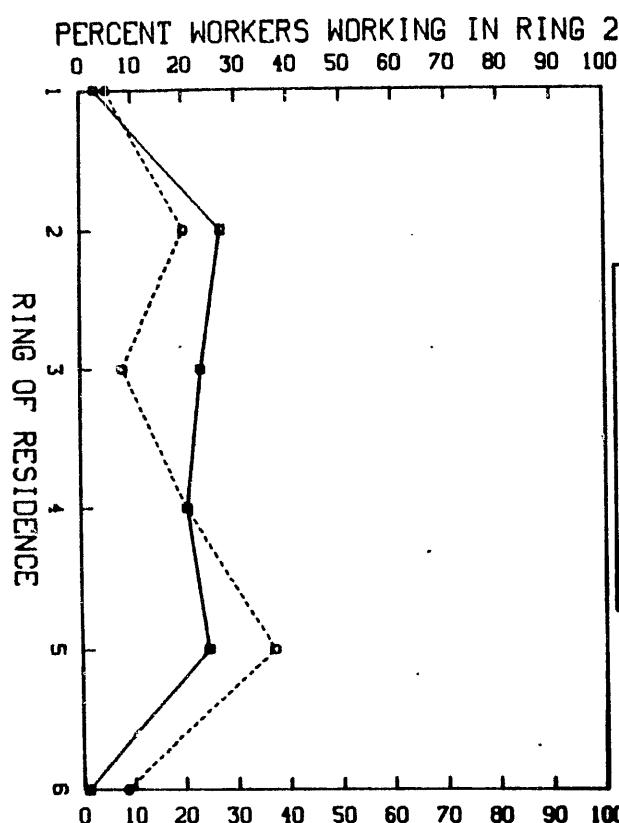


Figure III-3a

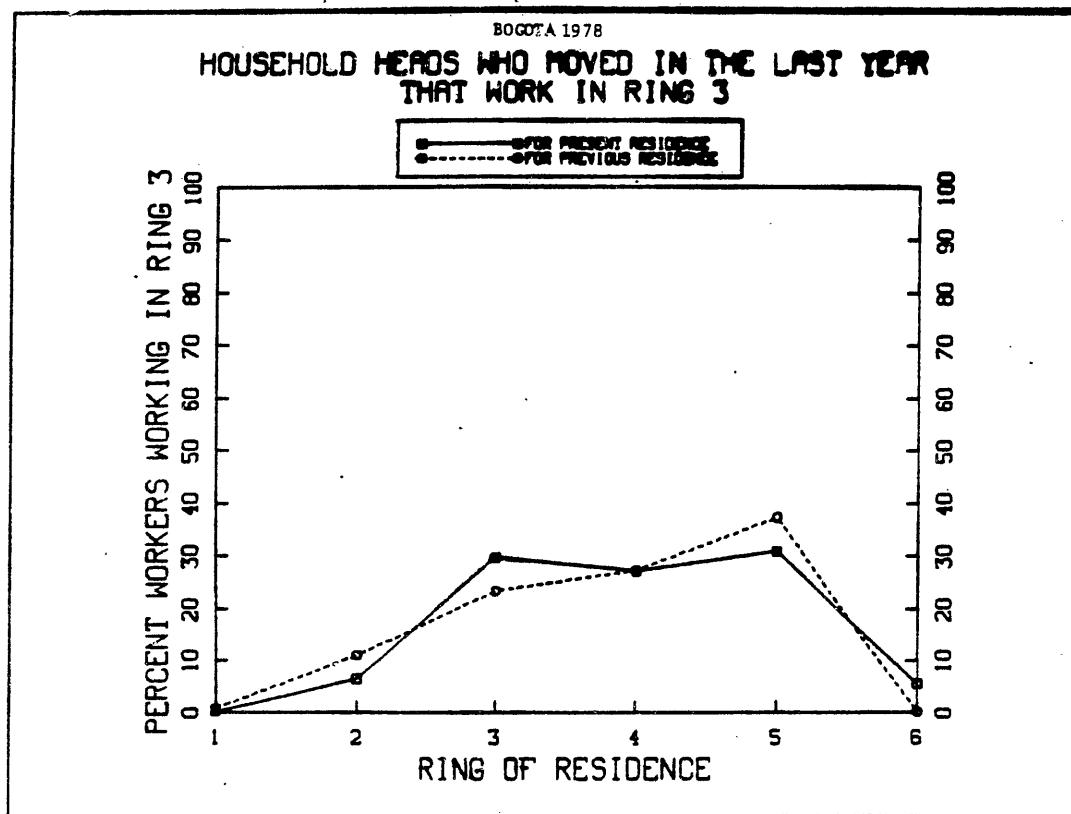


Figure III-3a

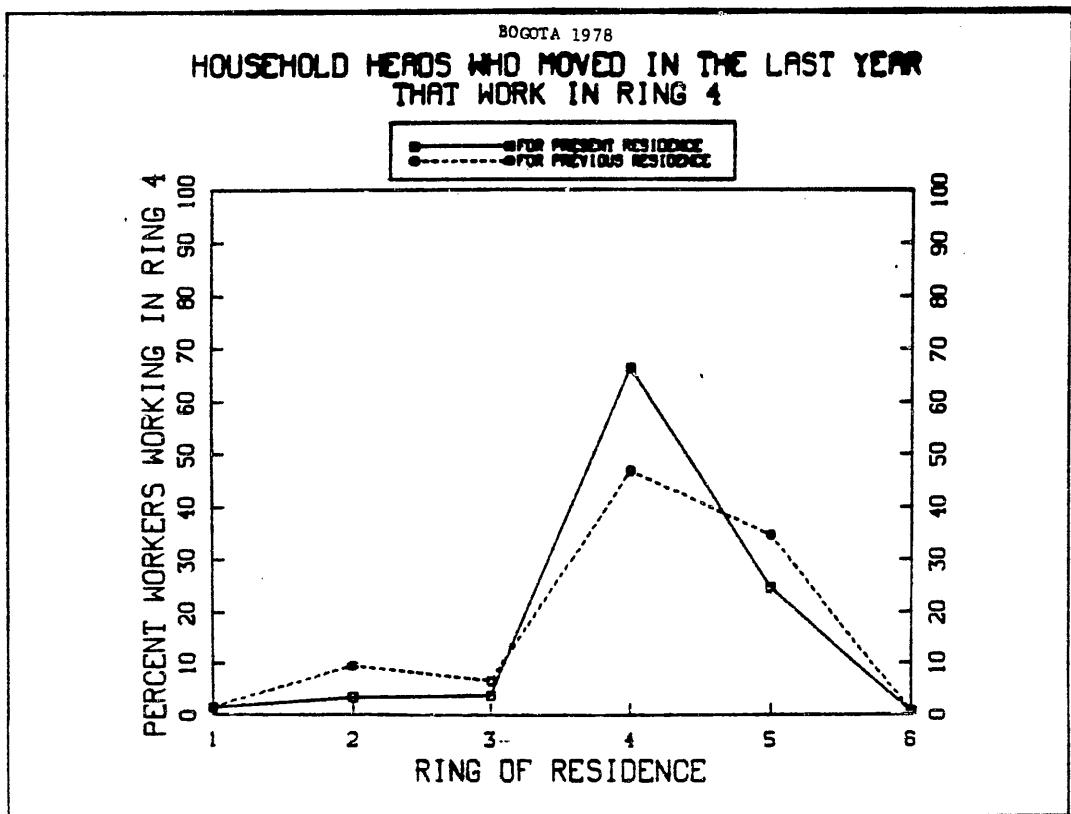


Figure III-3a

**HOUSEHOLD HEADS WHO MOVED IN THE LAST TERM  
THAT WORK IN RING 5**

Bogotá 1978

■ --- □ PREVIOUS RESIDENCE

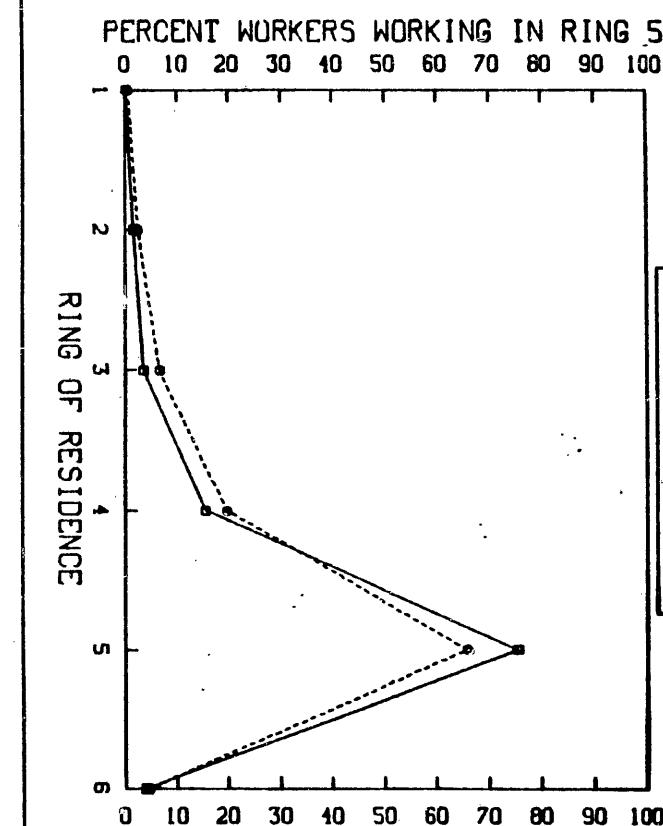
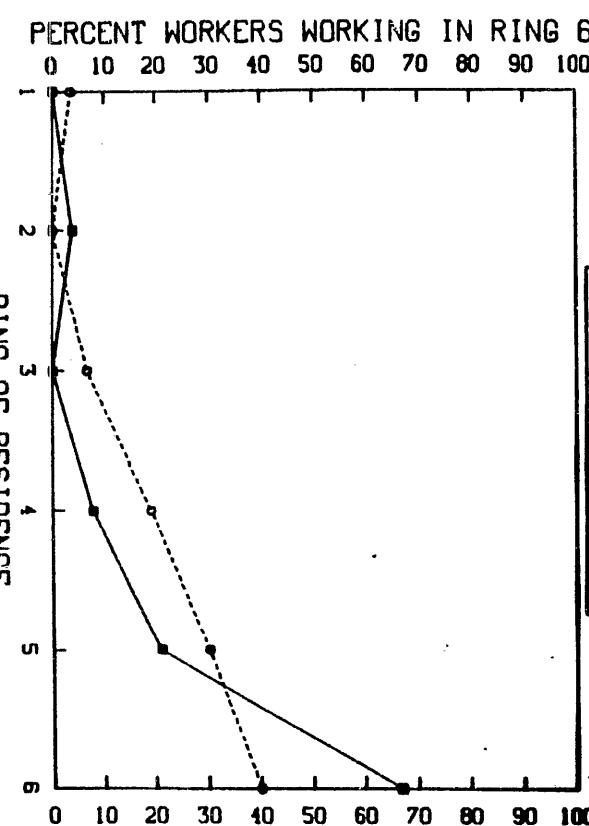


Figure III-3a

**HOUSEHOLD HEADS WHO MOVED IN THE LAST TERM  
THAT WORK IN RING 6**

Bogotá 1978

■ --- □ PREVIOUS RESIDENCE



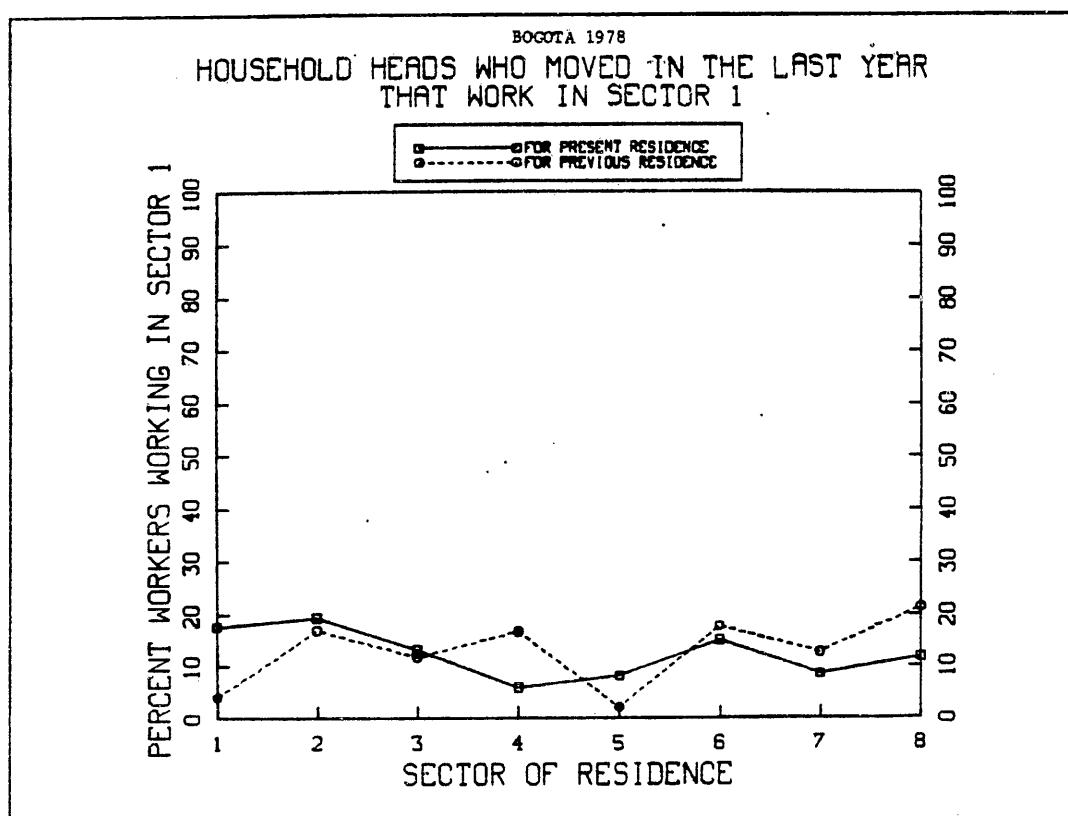


Figure III-3b

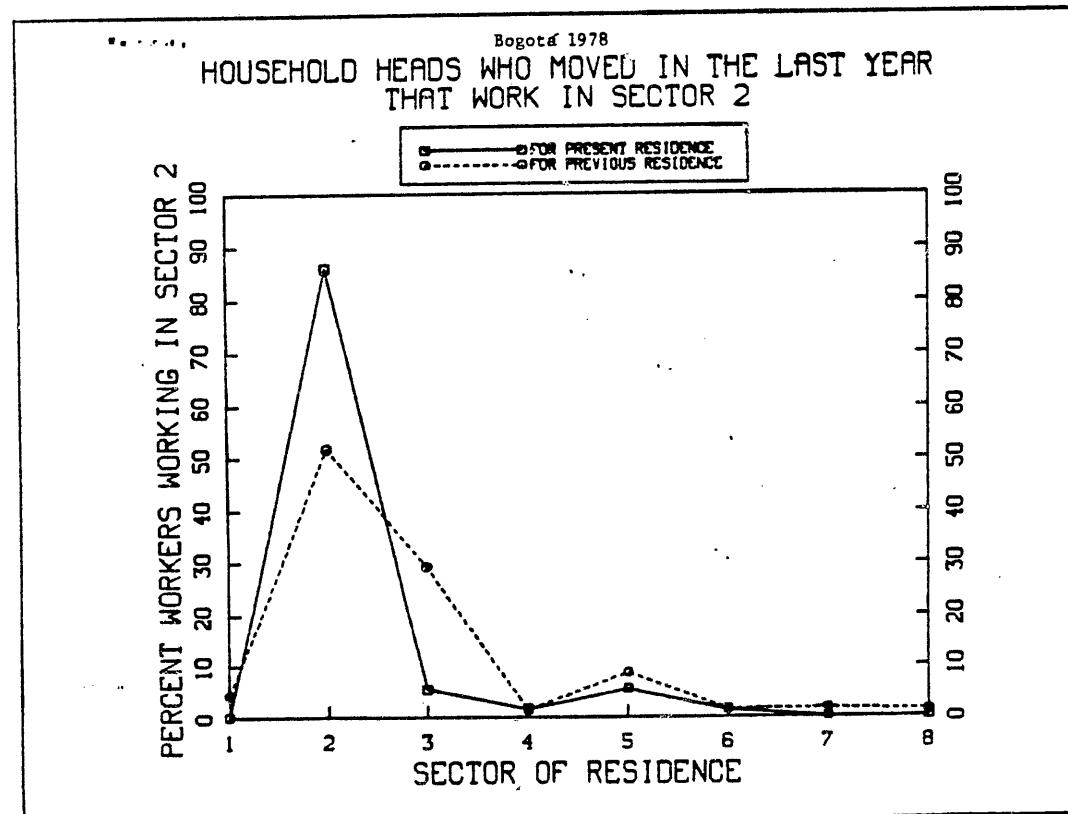


Figure III-3b

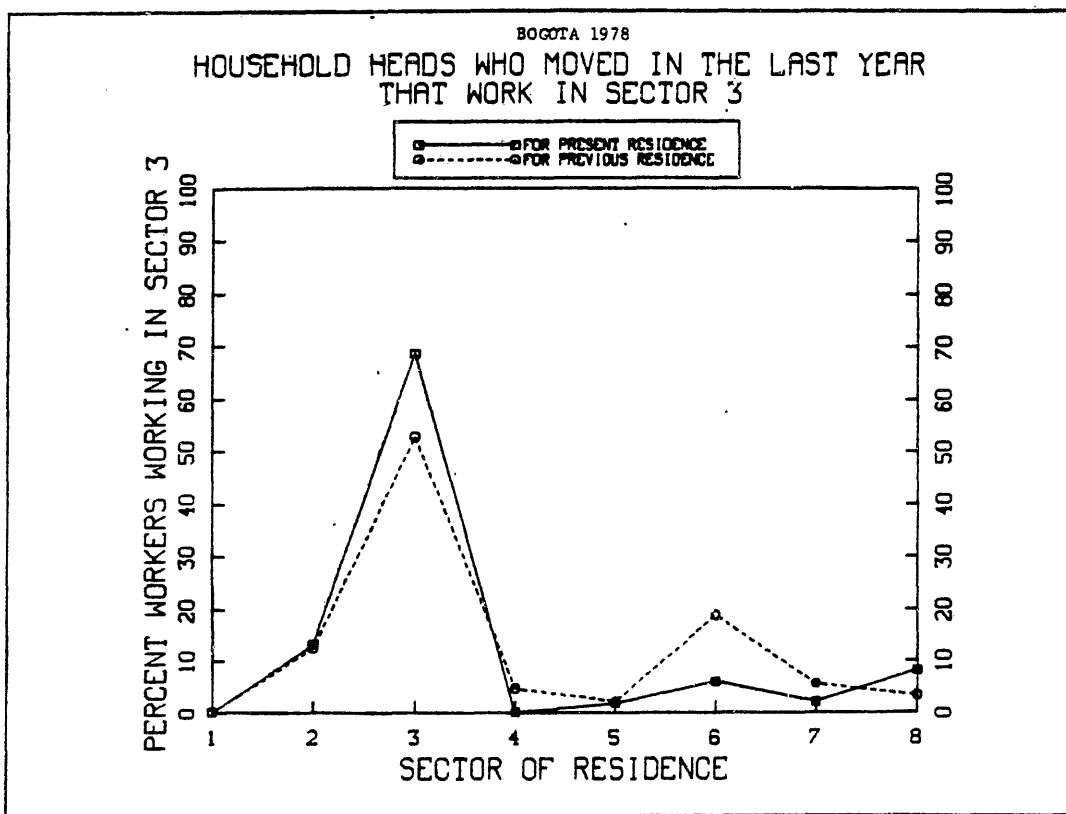


Figure III-3b

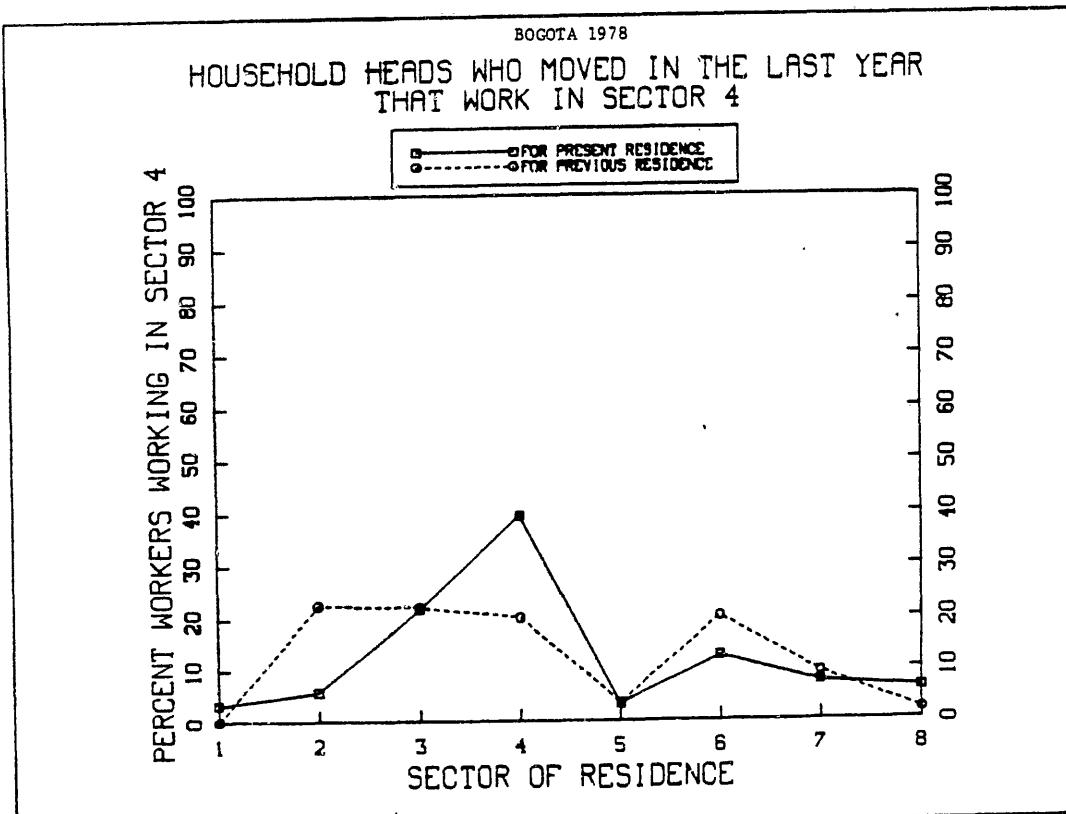


Figure III-3b

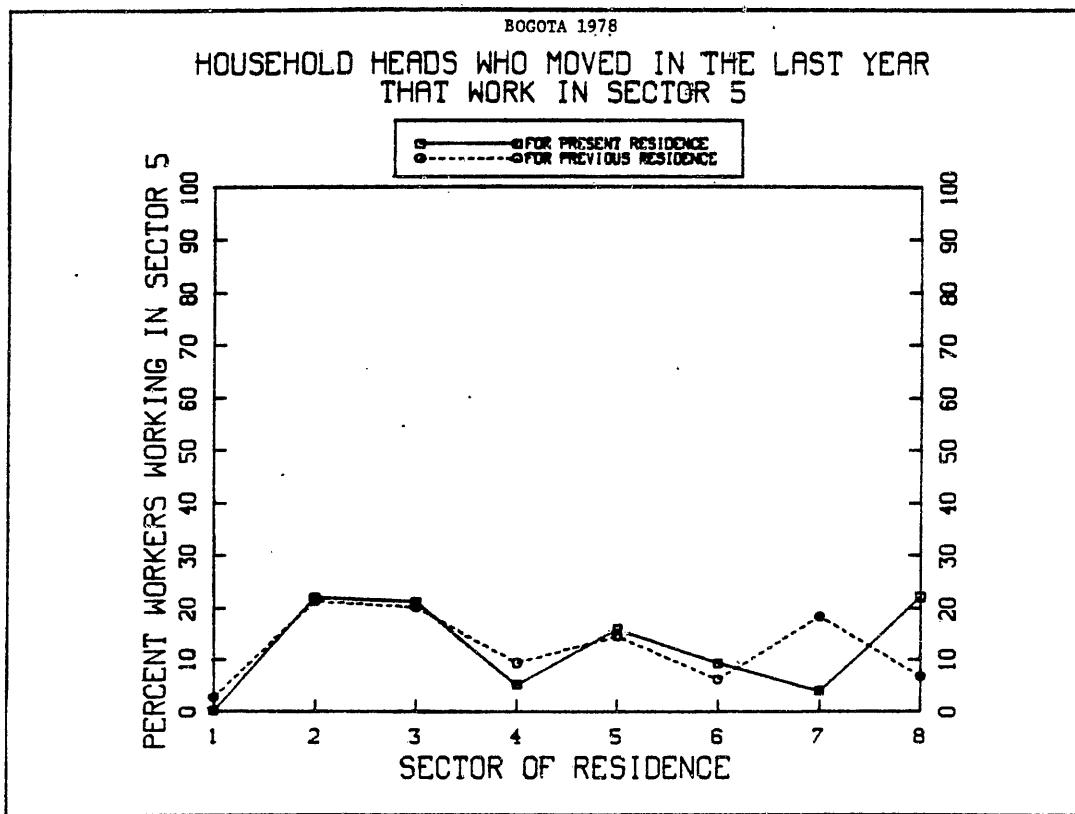


Figure III-3b

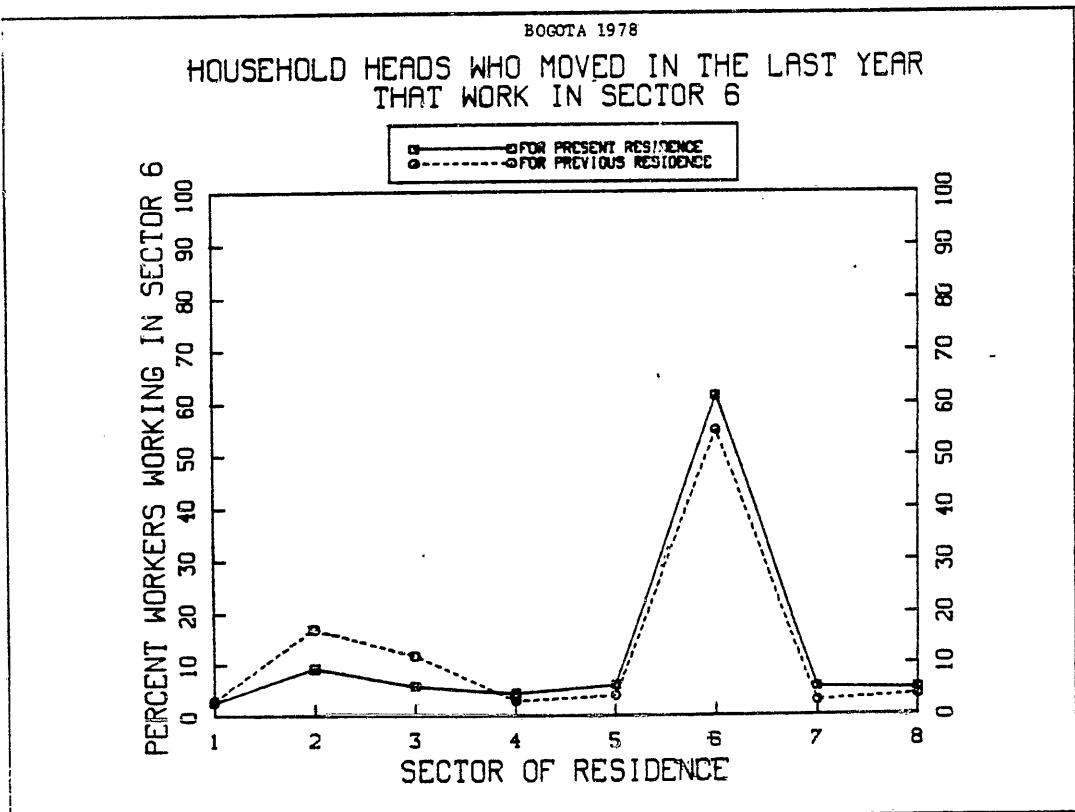


Figure III-3b

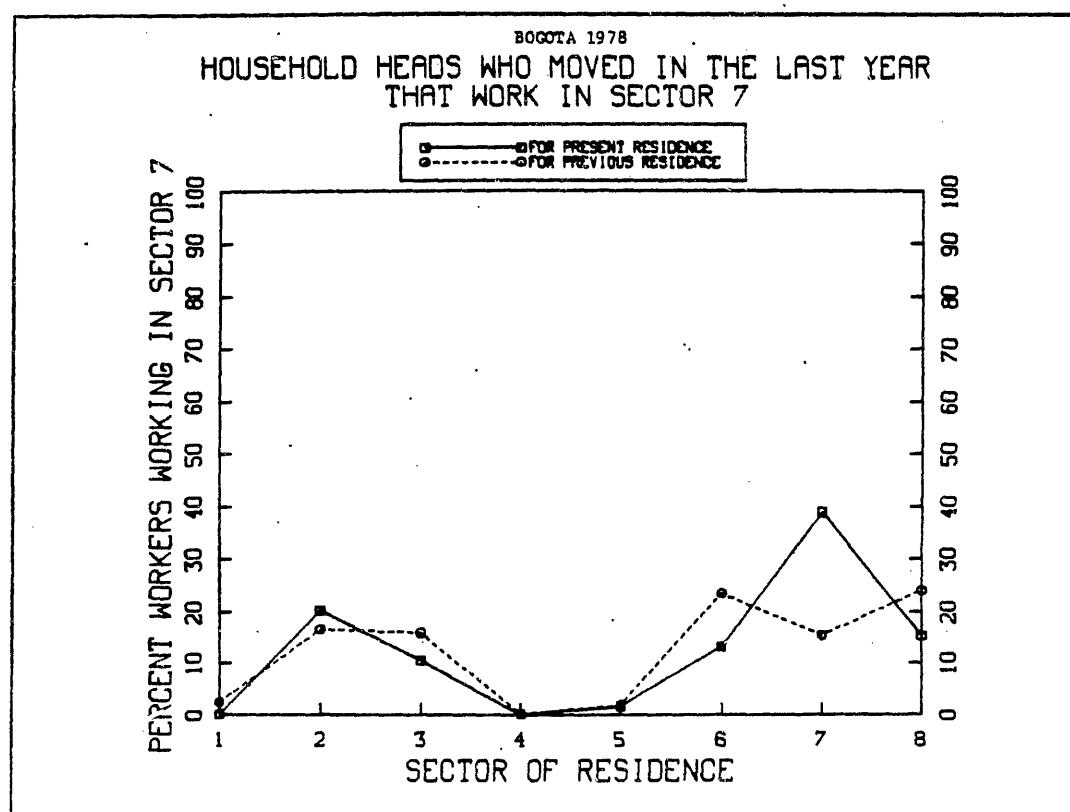


Figure III-3b

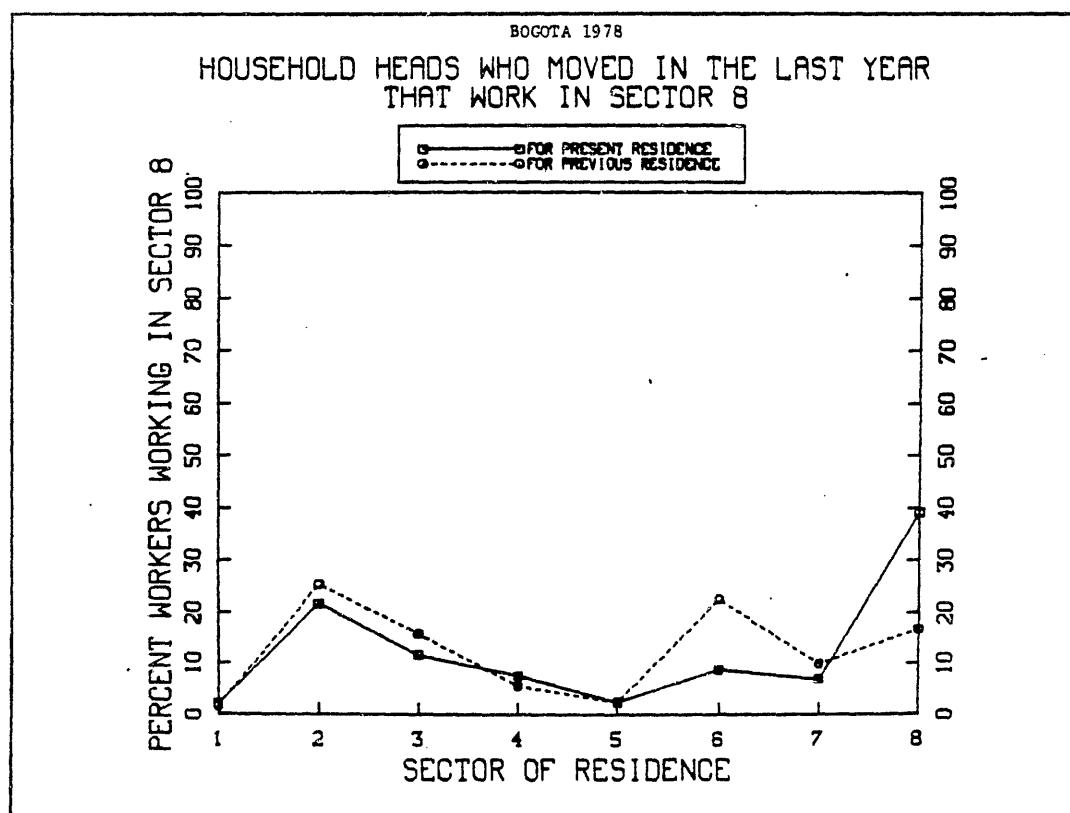


Figure III-4a

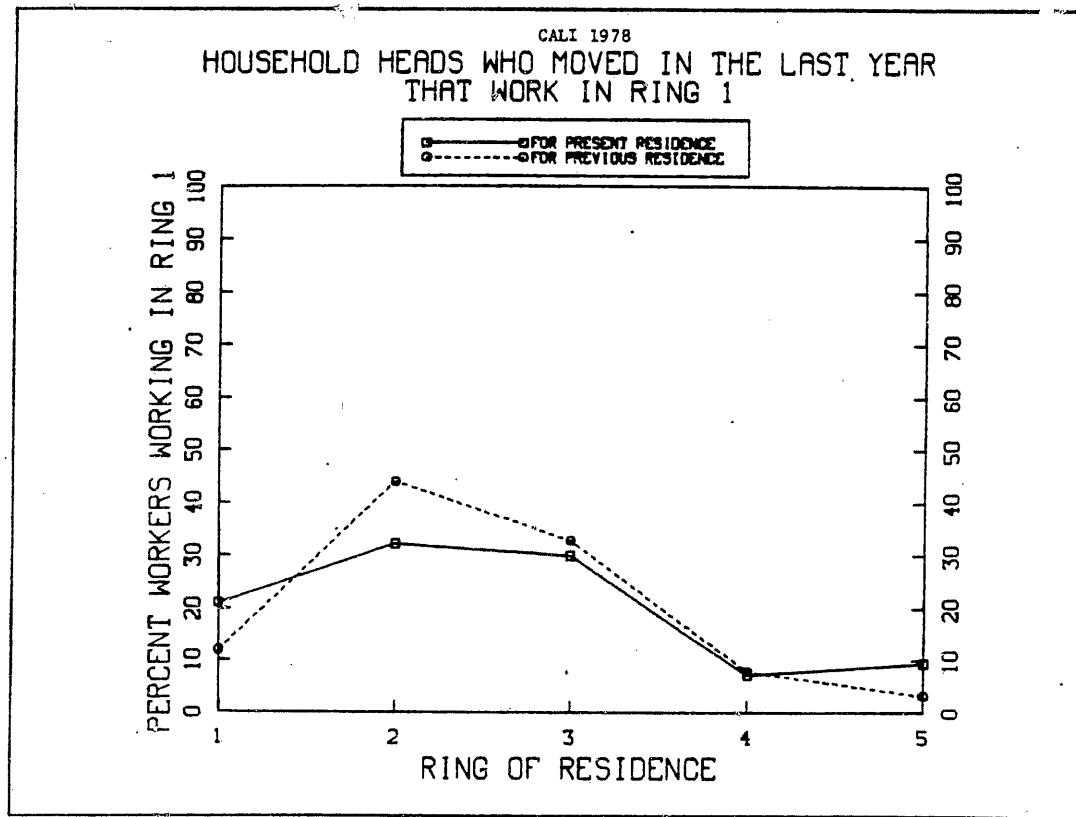
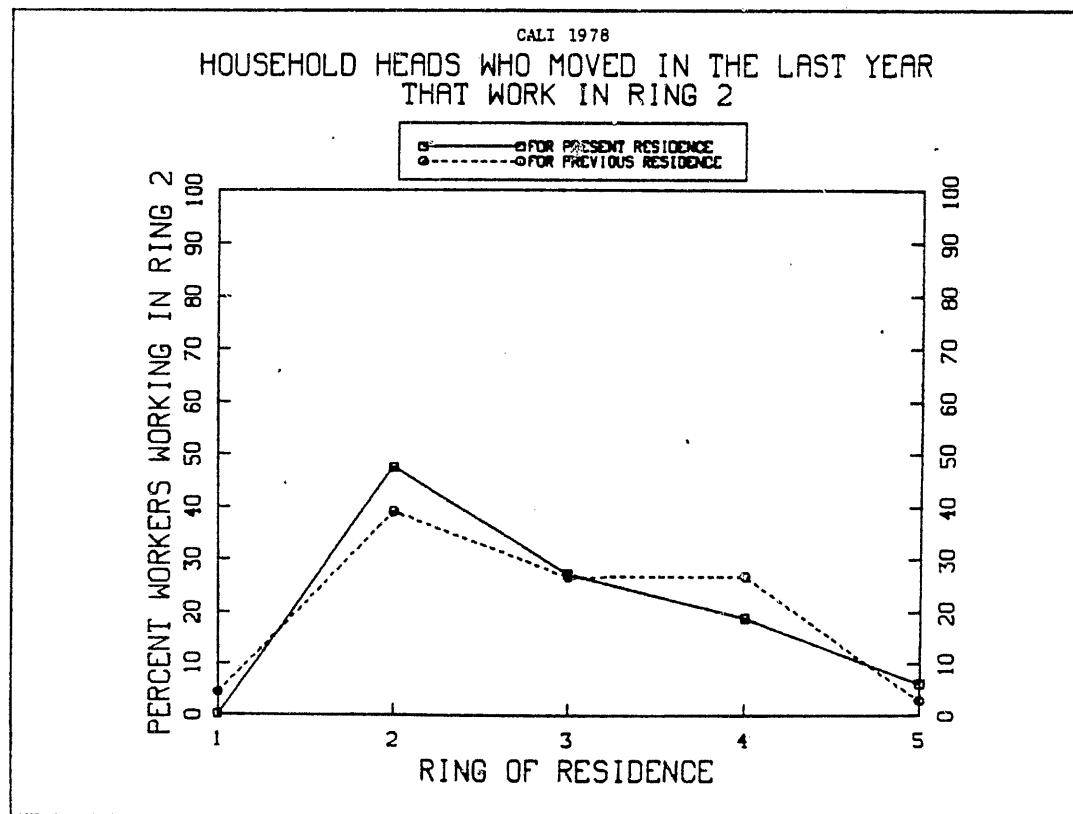


Figure III-4a



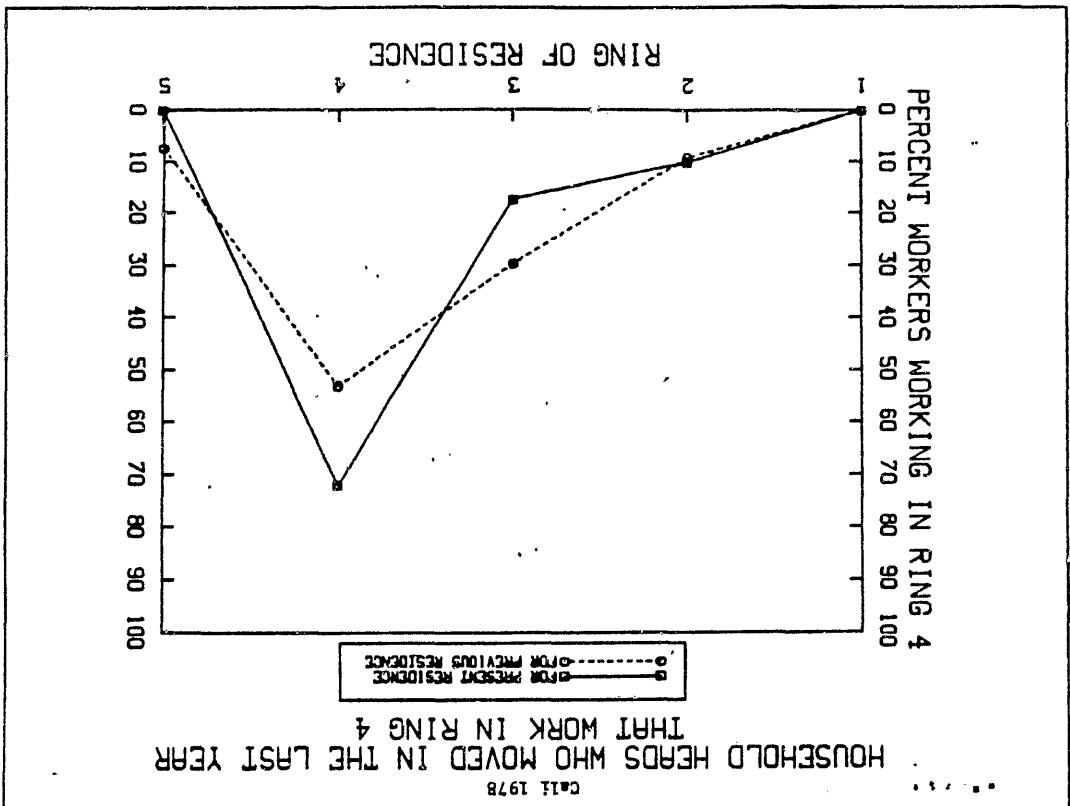


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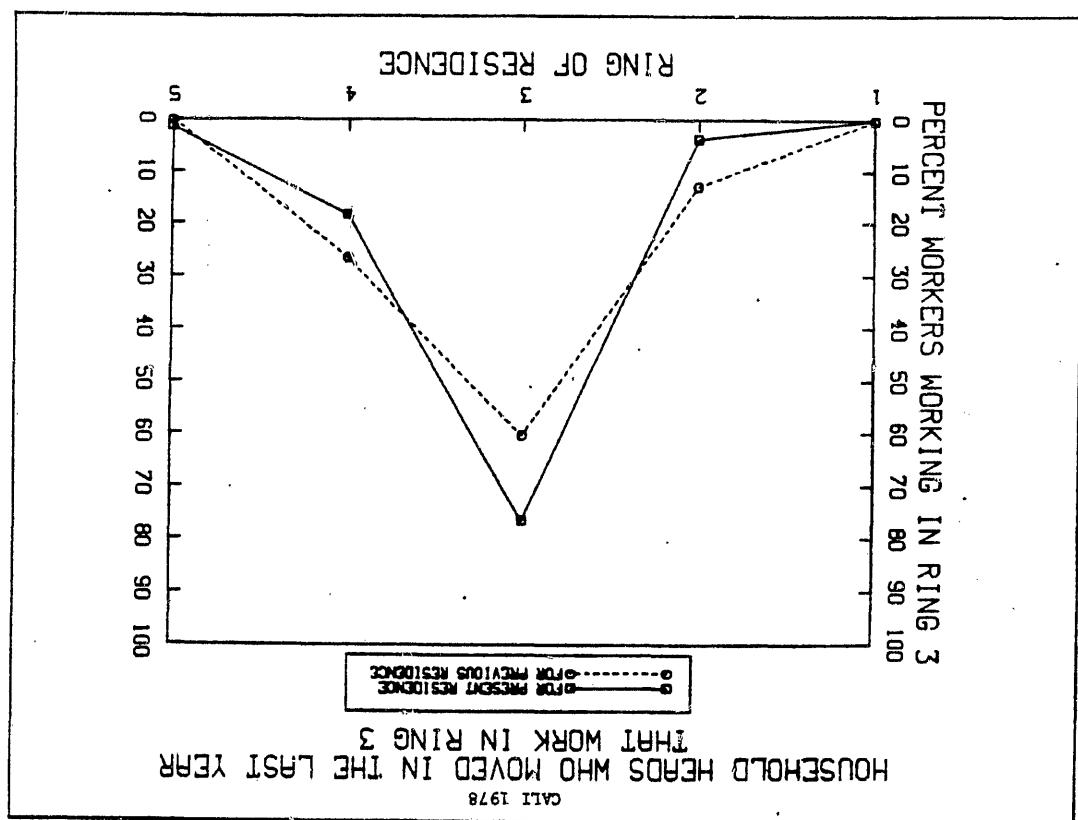


Figure III-4a

Figure III-4a

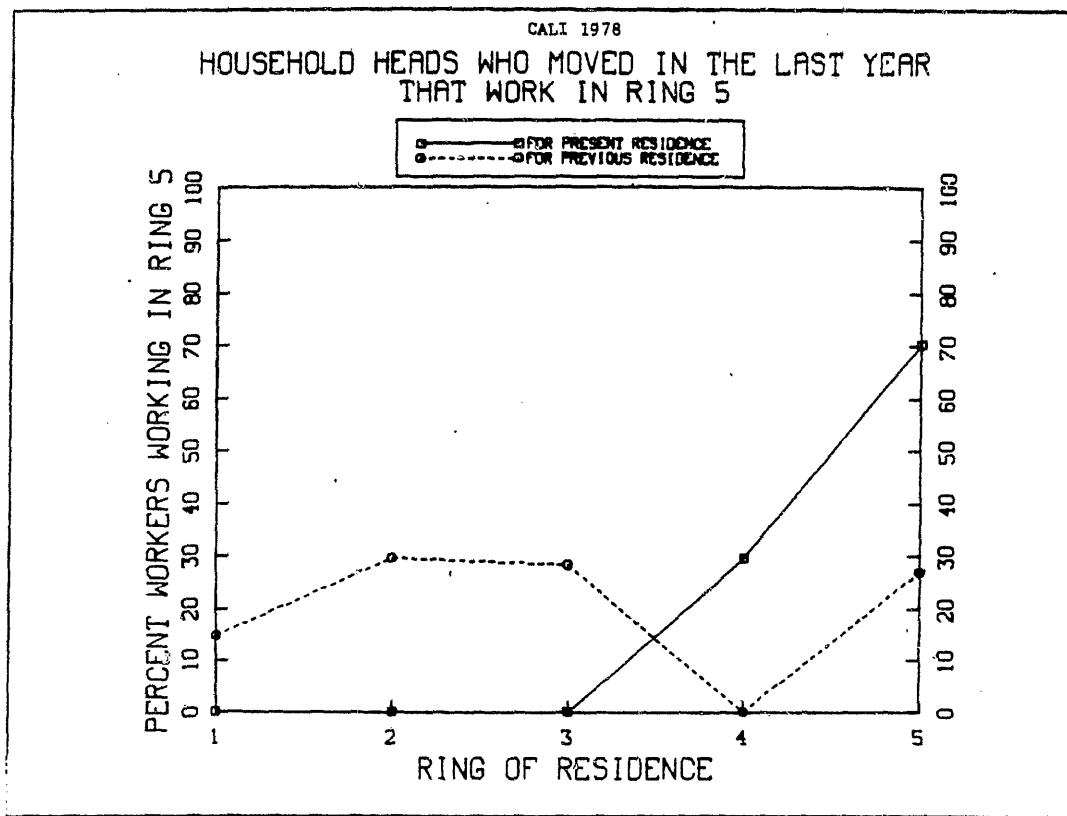


Figure III-4b

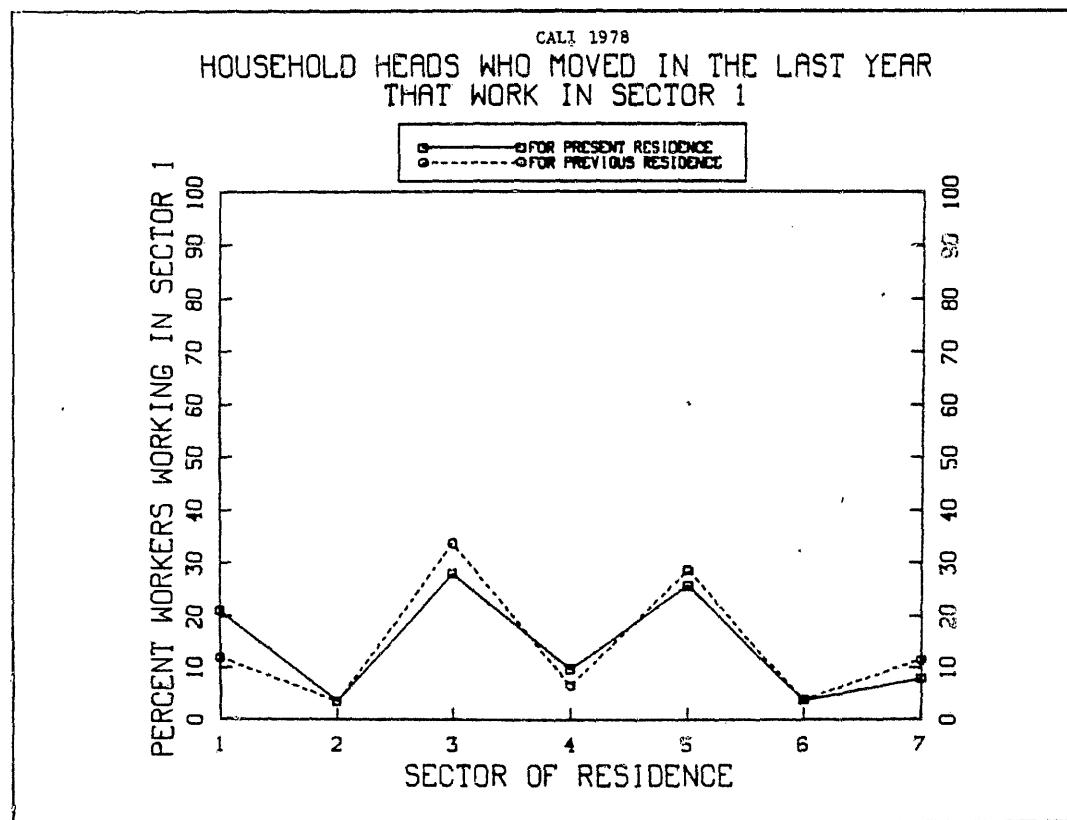


Figure III-4a

CALI 1978  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 2

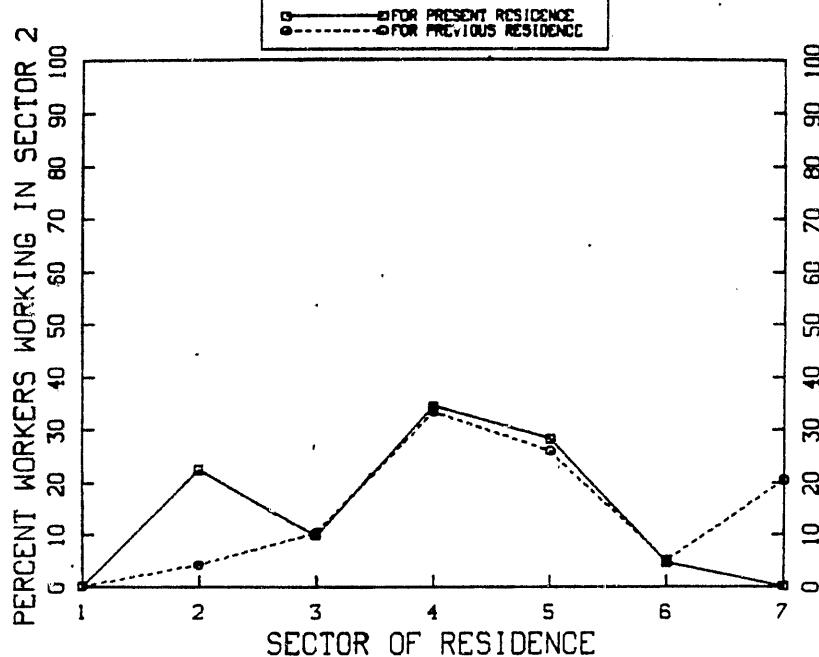


Figure III-4b

CALI 1978  
HOUSEHOLD HEADS WHO MOVED IN THE LAST YEAR  
THAT WORK IN SECTOR 3

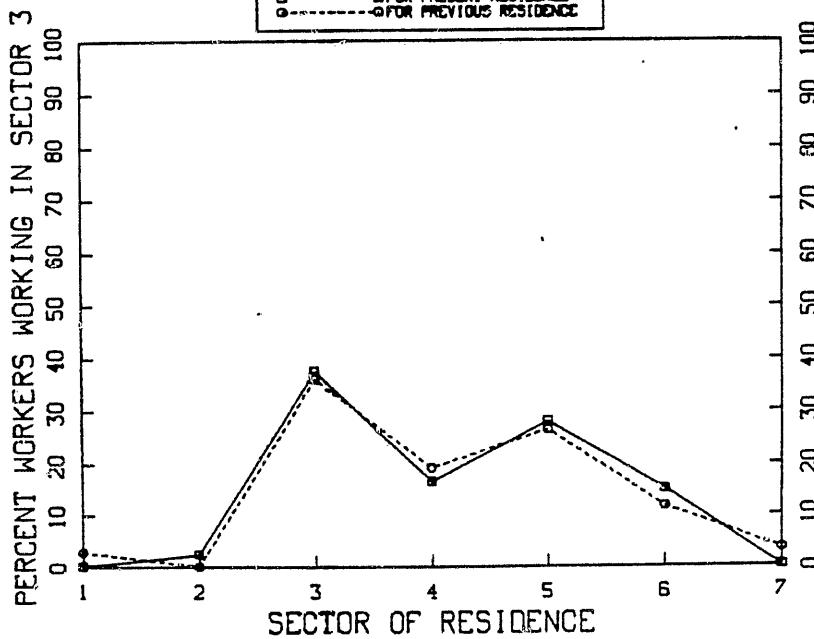


Figure III-4b

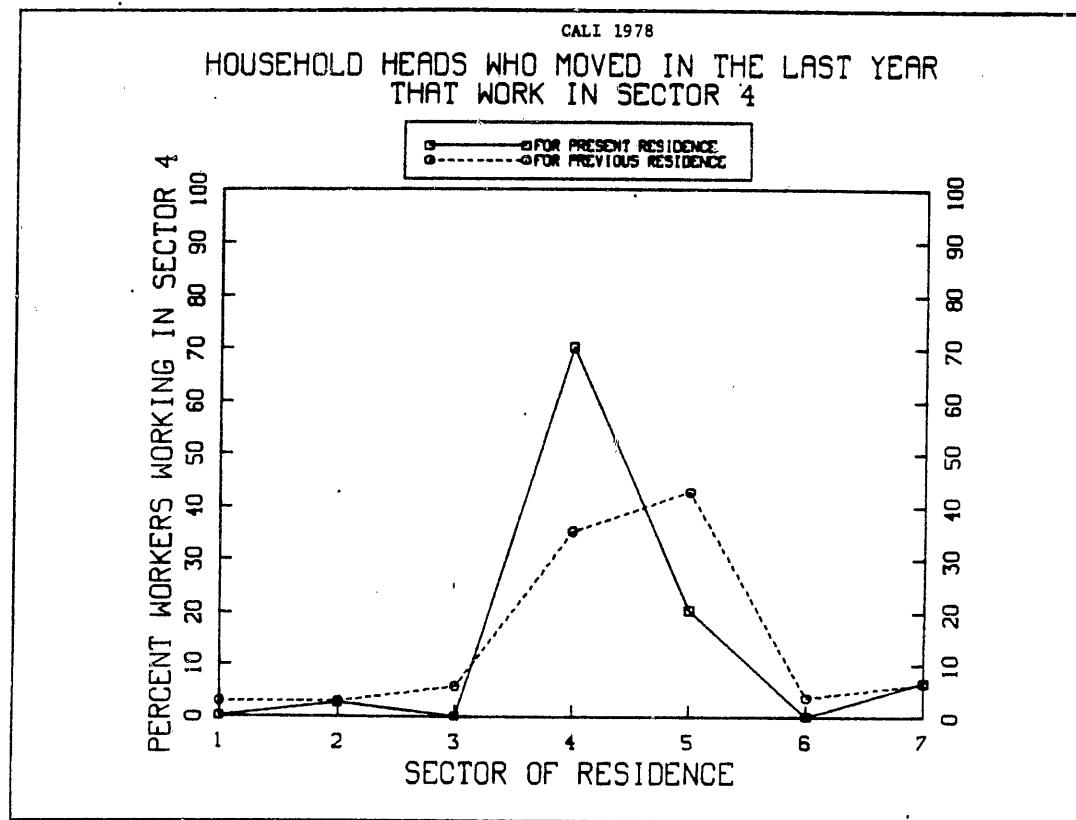


Figure III-4b

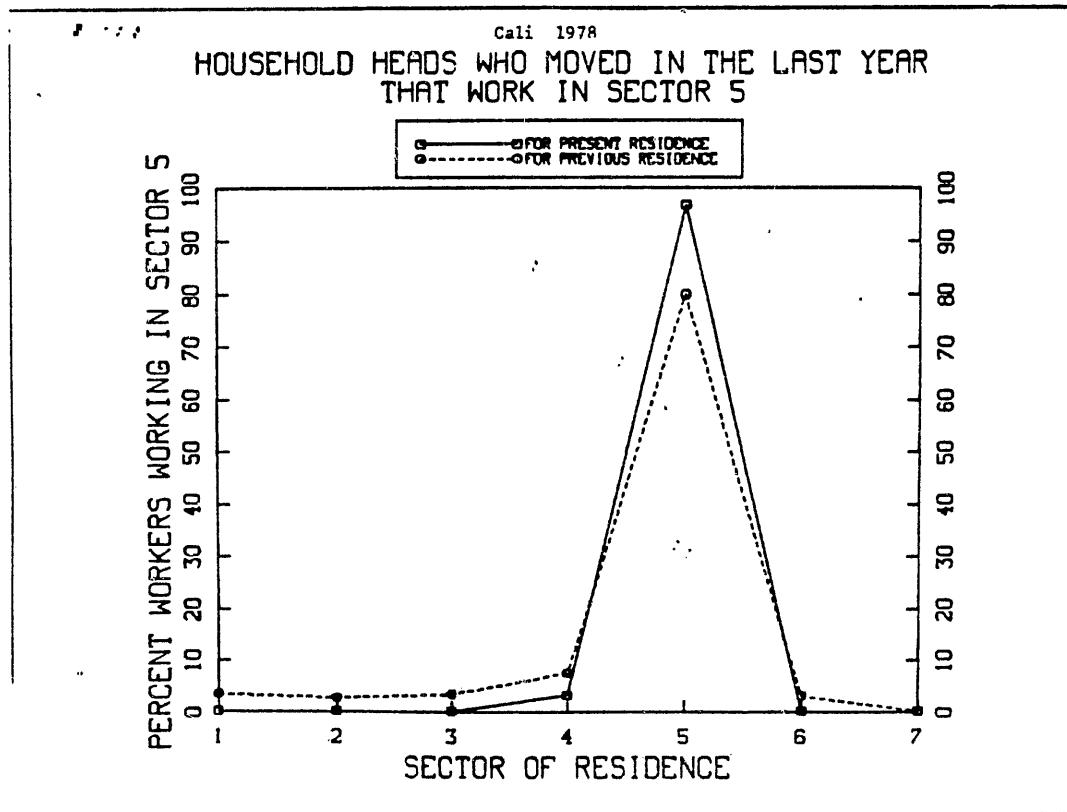


Figure III-4b

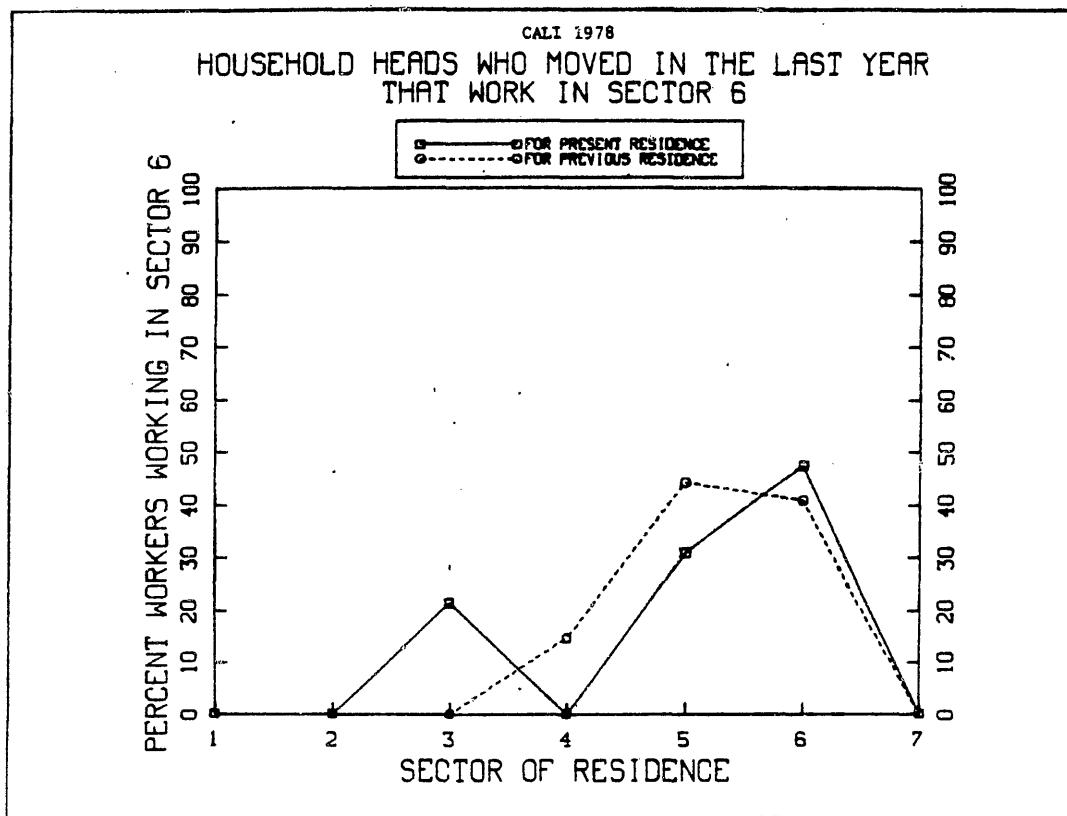
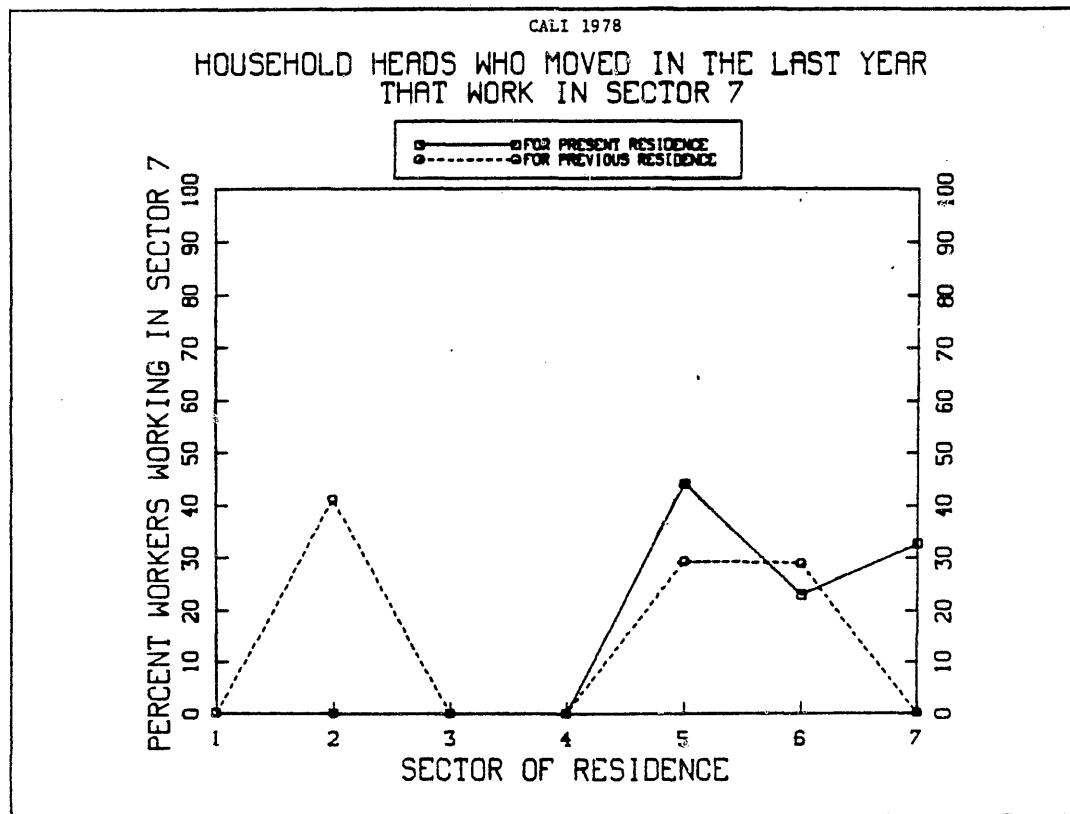


Figure III-4b



cannot be tested because of inadequate data.

More specifically, data contrasting present residence and employment locations by ring suggest that, as the constraint of high cost land disappears, clustering around job sites increases. Ring 1, 2, and 3 workers show far less clustering than workers in Rings 4, 5, and 6, when Bogota data is reviewed, for either 1972 or 1978. Even here, Rings 2 and 3 have a higher proportion of workers living within the same ring than Ring 1. The outer ring, which was undergoing a transition from rural to urban occupancy in the period in question, shows peak residential clustering for its workers shifting from Ring 5 (1972) to Ring 6 (1978), in line with one's expectations. In addition, the degree of clustering is greater in 1978 than in 1972 except in the case of Ring 2. As a result, the 1978 information reveals that clustering increases systematically from Rings 1 through 5, with Ring 6 totals approaching those of Ring 5.

The information obtained from Cali substantiates the trends suggested for Bogota. Half or more of the workers in Rings 2 through 5 live in their zone of work; the proportions exceed 70% in Rings 3, 4, and 5. Since at least three-quarters of the households in each of the cases studied live in the outer rings (4, 5, 6 in Bogota; 3, 4, 5 in Cali) and since, in those rings, most household heads live in the same zone where they work, it seems plausible to assume that the work-residence link is a fundamental one for the cities in question.

As already noted, while we have no information on previous employment locations of households heads who moved just prior to the survey period, we do know where they lived previously. In every single case (17 work zones, counting each Bogota case separately) the degree of clustering increases when one considers present as opposed to previous residence zone. Some increases are spectacular, as, for example, in Ring 5 in 1972 Bogota (42% to 71%) and Ring 5 in 1978 Cali (27% to 70%).

The data, when re-examined using sectoral aggregations, continue to yield the same type of conclusions about clustering even though there is no longer any "inner" versus "outer" ring phenomenon at work. There are many reasons not to expect heavy clustering by sector. In Bogota, for example, Sector 1, containing the CBD, is not an attractive residential location for its workers, for reasons such as those already explored in the ring analysis. Sectors 4 and 5 are part of a dense industrial corridor, many of whose workers could best be served in terms of amenities (some separation from factories), land costs, and easy access by remaining in the same ring but living in adjacent sectors. Sectors 7 and 8 house the better-off households to a greater degree than other zones, yet they provide employment for commercial sector and office activity workers as well as for domestic servants, many of whom may not be able to afford the level of amenities prevailing in these areas.

In Cali, Sector 1 contains the CBD. Arguments against the CBD as a residential location are similar to those presented in Bogota. Sectors 2 and 7 include an over-representation of upper income households as well as (in the case of Sector 2) a location for commercial sector activities. As in Bogota, these areas may be unattractive residential zones for lower income workers because of the high level of amenities found therein. Sectors 3 and 4 do seem more suited to clustering since they contain both important concentrations of industrial jobs and residential areas. Sector 5 is a predominately poorer area built on flood-prone land and with limited employment-generating potential. Sector 6 provides a development frontier in the south of Cali.

Nevertheless, substantial, often very high, proportions of a sector's workers who are household heads live in the self-same zone. Excluding Sector 1 in Cali and Bogota (where the high cost of residential land is a dominant factor in keeping its workforce from living there), one finds that in all but 5 of the remaining 20 data points (7 zones for each of the Bogota surveys and 6 for Cali), between two-fifths and 97% of the household heads live in the sector of employment. Furthermore, in every single case under study (23) the clustering is greater for present than for previous residence. Finally, when the residence is not located in the household heads employment zone, it is likely to be found in an immediately adjacent sector (Sector 1 excepted for obvious reasons). This is the case in 10 of the 20 cases under examination (Sectors 2, 3, 4 and 7 in Bogota 1972; Sectors 2, 3, 4 in Bogota 1978; and Sectors 4, 5, and 6 in Cali 1978).

Outside of the CBD, there are only a few cases of fairly widespread long-distance in-commuting where the latter sectors are identified as having low levels of clustering and low levels of commuting from immediately adjacent sectors. For purposes of discussion, this translates into levels of in-commuting from non-adjacent sectors of 15% or more. In Bogota Sector 5 (in the industrial corridor) imports between one-third and two-fifths of its labor force from Sectors 2 and 3 combined (depending on the year). Similar proportions are imported from the self-same sectors into the "rich" sector 8 in 1972 and 1978. Sector 7 in 1978 also brings in a fifth of its work force from Sector 2. In Cali, Sectors 2, 3 and 7 are all heavy importers of labor from one or two non-adjacent sectors. Sector 2 imports 63% of its household head workers from Sectors 4 and 5; Sector 3 imports 43% from Sectors 5 and 6; and Sector 7 imports 44% of its household workers from Sector 5.

For the sake of perspective, one should keep in mind that the residence-to-work commuting distances in Bogota and Cali are not large. The mean distance for all recent movers household heads in Bogota 1972 is 5.8 kilometers. The recent mover resident household heads in each sector have mean commutes all of which are relatively close to the overall mean. While the highest commutes are found among Sector 2 and Sector 3 household head workers, the mean there is still only 6.4-6.5 kilometers. For Bogota as a whole only 10% of these types of workers have intersectoral commutes which average more than twice the mean, or 11.6 kilometers, and these range from 12 to 16 kilometers.

Much the same can be said for Bogota 1978. The average commute of recent movers is similar, or 5.3 kilometers. The highest commuting distance, by sector of residence, is found in Sector 2, where the level is still only 7 kilometers. While there are, as before, sector-to-sector commutes that exceed twice the overall mean, they cover only 11% of the recent mover household heads. These long sector-to-sector commutes fall between 11 and 15 kilometers.

Cali, being a small city, has correspondingly shorter journey-to-work distances, for recent movers averaging 2.8 kilometers. None of the sector-of-residence to sector-of-work mean distances exceed 4 kilometers and all sector-to-sector means in excess of twice the overall mean average between 6 and 7 kilometers in length.

There is, therefore, relatively little reason to despair about the fate of workers as represented by recent mover household heads. Very few sectoral groups are involved in journeys to work which measure more than 5 to 10 kilometers in length.<sup>13/</sup>

Except for those cases where particular sectoral characteristics militate against heavy worker clustering of their residences around the work place, what could explain the tendency to concentrate, when the simple model applied to the concentric rings is no longer applicable?

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<sup>13/</sup> The use of all-household commuting distances instead of those for recent movers only does not change the conclusions. For Bogota 1972 the mean commute is 5.6 kilometers and only 8% of households are found in sector-to-sector cells with commutes that are more than twice as long. For Bogota 1978 the relevant data are 5.2 kilometers and 11%, once again. For Cali the average commute is 2.9 kilometers and, as above, only 11% of the households are found in sector-to-sector cells with commutes that are more than twice as long. The Cali data for recent movers and for all households excludes those residents, living in Sectors 3 and 4, who work in Yumbo, an industrial suburb. Mean commutes for those involved is 13.8 kilometers.

As noted, one can imagine at least one set of hypotheses to explain this behavior. Information about job opportunities for household heads and secondary household workers, as well as about residential space and neighborhood amenities, is not costless. It may well be that one way to minimize costs while achieving objectives that have a locational component is to limit one's search to areas that are already well-known by the household, either from direct experience or by drawing on the experience of friends or relatives (particularly, in the latter case, for newly arrived migrants). One can imagine recourse to locations distant from the household's "customary" neighborhood areas only insofar as these find nearby options very unsatisfactory. The amount of search activity would presumably be a function of certain household characteristics. This would help explain not only sectoral clusterings around the household head's workplace but also the fact that residential moves appear to cover short distances (rarely more than 8 kilometers) <sup>14/</sup> and show heavy clustering around prior residence locations.

If such hypotheses are correct, then it would be useful to identify household characteristics that explained distance moved or preference for within as between sector moves.

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<sup>14/</sup> In all 3 surveys 20% or fewer of the moves exceed 8 kilometers in length. In fact, Cali moves rarely exceed 4 kilometers (14%). (Table III-11).

#### Household Characteristics and Relocation Behavior

One might speculate that the desire to economize on search costs is most prevalent among those who are poor, those who are new to the urban area, those with few assets and/or little experience (here proxied by the young), and those who have little to gain from extensive searches (renters). No particular a priori hypotheses can be formulated for other variables that are conveniently used to differentiate households. Female-headed households might be included among those less willing to move greater distances, under the assumption that they are poorer, on average and that they have few assets, like a home. Since the latter statement can be shown to be false, and present owners can be expected to move farther either because of their previous asset accumulation as prior owners or because they are motivated to search for a bargain, as first time owners, it is hard to predict the expected outcome. Households headed by an individual without a spouse might simultaneously be thought of as less footloose (poorer, less experienced, renting space) and more footloose (especially if the category is thought of as including singles who are unmarried or widowed individuals without young children). Smaller households might have less difficulty satisfying their demands with limited search yet they would be relatively footloose; larger households might be precisely the ones that are less footloose and the ones who are likely to move farther in search of a bargain. Finally, one can assume that increasing the number of household workers complicates the moving decision, forcing additional trade-offs to be considered; whether this would increase the distance moved or not as the number of workers rises is not obvious.

A Look at the Determinants of Distance Moved by Relocating Households

In searching for explanations of relocation distances associated with different households, it is necessary first to issue a warning about the nature of the data. Not only are sectoral boundaries arbitrary constructs, but the distance measures are very crude approximations of the door-to-door distances involved. In particular, distances moved in the 1978 survey reflect neighborhood centroid-to-centroid measurements with within-neighborhood moves recorded as zero kilometers. For 1972 there are no barrio-level measures available; instead an average of 6 to 7 neighborhoods are grouped into zones and within zone movements are unknown. For this reason the 1972 data are not reviewed below. Instead the 1978 surveys are used to clarify the impact of various factors on distance moved. One of these is the sector of origin, thus allowing a test of the locational disadvantage hypothesis.

Cross-tabular results are presented in Table III-5. Two conclusions are quickly apparent: in most tables deviations from the overall mean are less than 0.5 kilometers, suggesting the variables chosen have limited explanatory power; in addition the conclusions from one city do not easily translate to the other, pointing to the role of omitted variables which are city-specific.

The four variables for which a priori judgments were rendered do generally perform as expected. In both cities, the poor, those new to the area, the young, the renters, and those with short tenures in their previous dwellings, all move shorter distances than their counterparts. Even here, however, there is evidence of more complex

Table III-5

Recent Mover Distances Moved by Various Household Characteristics

A. Household Income

1. Bogota 1978

<u>Income</u>	<u>Mean Distance</u>
4000 pesos or less	3.4 km
4001 - 8000 pesos	4.3 km
Over 8000 pesos	3.6 km
Total	3.8 km

2. Cali 1978

<u>Income</u>	<u>Mean Distance</u>
3500 pesos or less	1.5 km
3501 - 7000 pesos	1.6 km
Over 7000 pesos	2.2 km
Total	1.8 km

B. Household Head Age

1. Bogota 1978

<u>Age</u>	<u>Mean Distance</u>
30 years or less	3.7
31 - 40 years	4.0
Over 40 years	3.7
Total	3.8

2. Cali 1978

<u>Age</u>	<u>Mean Distance</u>
30 years or less	1.7
31 - 40 years	2.2
Over 40 years	1.8
Total	1.8

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C. Household Head Marital Status

1. Bogota 1978

<u>Marital Status</u>	<u>Mean Distance</u>
Has spouse	3.9
No spouse	3.3
Total	3.8

2. Cali 1978

<u>Marital Status</u>	<u>Mean Distance</u>
Has spouse	2.0
No spouse	1.6
Total	1.8

D. Household Head Sex

1. Bogota 1978

<u>Sex</u>	<u>Mean Distance</u>
Male	3.8
Female	3.6
Total	3.8

2. Cali 1978

<u>Sex</u>	<u>Mean Distance</u>
Male	1.9
Female	1.6
Total	1.8

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E. Household Number of Workers

1. Bogota 1978

<u>Number</u>	<u>Mean Distance</u>
0	4.1
1	3.9
2 or more	3.6
Total	3.8

2. Cali 1978

	<u>Mean Distance</u>
0	1.4
1	1.7
2 or more	2.1
Total	1.8

F. Household Size

1. Bogota 1978

<u>Size</u>	<u>Mean Distance</u>
1 -5 members	3.8
Over 5 members	3.8
Total	3.8

2. Cali 1978

1 - 5 members	1.8
Over 5 members	2.1
Total	1.8

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G. Tenure Status

1. Bogota 1978

<u>Status</u>	<u>Mean Distance</u>
Owner	4.5
Renters	3.6
Other	4.2
Total	3.8

2. Cali 1978

<u>Status</u>	<u>Mean Distance</u>
Owner	2.6
Renter	1.7
Other	1.7
Total	1.8

H. Years in Previous Dwelling

1. Bogota 1978

<u>Years</u>	<u>Mean Distance</u>
Under one year	3.7
One year or more	3.8
Total	3.8

2. Cali 1978

<u>Years</u>	<u>Mean Distance</u>
Under one year	1.3
One year or more	2.0
Total	1.8

Page 5 of Table III-5

I. Migrancy Status

1. Bogota 1978

<u>Migrancy Status</u>	<u>Mean Distance</u>
Migrated within last 5 years	3.6
Long-term resident	3.8
Total	3.8

2. Cali 1978

<u>Migrancy Status</u>	<u>Mean Distance</u>
Migrated within last 5 years	1.3
Long-term resident	1.9
Total	1.8

J. Household Head Sector of Previous Residence

1. Bogota 1978

<u>Sector</u>	<u>Mean Distance</u>
1	4.4
2	4.3
3	3.2
4	2.7
5	3.3
6	4.2
7	3.9
8	4.2
Total	3.8

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J. Household Head Sector of Previous Residence

2. Cali 1978

<u>Sector</u>	<u>Mean Distance</u>
1	1.8
2	2.1
3	1.8
4	1.4
5	1.7
6	7.1
7	2.9
Total	1.8

behavior: as income increases in Bogota, the distance moved eventually falls back; the same effect is noticed in both cities when household head age is considered.

For other variables those for which no a priori conclusions can be reached, the results are less clear. Married and male household heads both tend to move greater distances than other households; this is true in both cities. Household size appears to play no role in Bogota, when above and below mean sizes are compared; in Cali larger households do seem to search farther afield than do smaller ones. A sectoral effect is evident in Bogota and Cali, but only in the latter case are the sectors defined as "poor". In Bogota below mean distances moved are found for former residents of Sector 3, which can be characterized by some measures (such as mean sector income) as poor. The relatively short distances found among Sector 4 and 5 movers are more likely to provide support for the hypothesis that zones with large populations are associated with relatively short moves.

Finally, the association between the number of household workers and distance moved is negative in Bogota and positive in Cali. Here, as elsewhere, the cross-tabulations are only rough indicators of what a more careful review of the data would uncover, even in the absence of multivariate analysis. Perhaps the impact of only workers contributing above some minimum threshold percent of household income should be counted. Alternatively the number of categories considered should be expanded from the three listed to a greater number.

The Determinants of Distance Moved: A Review of Multivariate Results

Table III-6 presents two sets of regressions each for Bogota and Cali, omitting those moves that were confined to the neighborhood or origin and thus not subject to easy measurement. The results for Cali appear far more susceptible to modelling than those for Bogota.

The estimators are presented both with and without squared terms. There is no a priori reason to prefer one model to another. In the cases examined the model with squared terms performs better in Bogota; the opposite is true in Cali.

The cross-tabulations suggest that distance moved is positively associated with prolonged residence in the city, increasing length of tenure in previous residence, a shift to owner-occupied housing, increasing numbers of household workers (Cali), and the presence of a spouse. Previous residence in a sector classified as disadvantaged is negatively associated with distance moved in Cali, but not in Bogota. Household income and household head age tend to be positively associated with distance moved at low values, but thereafter the relationships reverse themselves. Family size and the sex of the household head did not prove to be useful discriminants in the cross-tabular results.

Table III-6

Distances Moved by Recent Movers

Dist = f (Y, Age, FS, Workers, Yrvdu, DSex, Downer, DMigrant1,  
DMigrant5, DMarried, DSect, Popden)

Variable List

Dependent Variable

Dist = Distance Moved in meters  
calculated using Barrio centroids  
x + y coordinates

Independent Variables

Y = Labor + Non-labor income in 1000 pesos

Age = Household Head Age

FS = Family Size

Workers = Number of Household Workers

Yrvdu = years household lived in previous dwelling  
unit

DSex = Household Head Sex; 1 if female

Downer = Dummy variable for present tenure; (1 if owner)

DMigrant1\* = Dummy variable (1) for migrants in the  
city for less than or equal to one year

DMigrant5\* = Dummy variable (1) for migrants in the city for  
more than one year but less than or equal to  
five years

DSect\*\* = Dummy variable (1) for previous residence in  
poor sectors

Popden. = Population density of subsector (comuna) of  
previous residence

\* Migrants whose previous residences are outside  
of the city are excluded

\*\* (for Cali run poor sectors are 3, 4 and 5  
(for Bogota run poor sectors are 2, 3 and 6

Distance Moved by Recent Movers  
- Bogota 1978 -  
Within Barrio Moves Excluded

	<u>Est. Coef.</u>	<u>Elasticities</u>	<u>Est. Coef. w/ sq. terms</u>	<u>Elasticities</u>	<u>Mean Values</u>
Constant	4303.49 (5.03)*		1546.87 (0.86)		
Y	-10.90 (0.82)	-0.024	-13.78 (0.54)	-0.030	11.10
$Y^2$			0.01 (0.05)		
Age	9.29 (0.52)	0.066	100.54 (1.16)	0.162	35.32
$Age^2$			-1.10 (1.09)		
FS	60.61 (0.58)	0.051	584.57 (2.11)	0.143	4.20
$FS^2$			-49.44 (2.15)		
Worker	-114.50 (0.51)	-0.035	-9.27 (0.04)	-0.003	1.54
YRPVDU	55.83 (1.47)	0.040	65.72 (1.72)	0.047	3.55
Sex	233.84 (0.40)		130.40 (0.22)		0.203
Own	1032.48 (2.14)		954.75 (1.97)		0.191
MIG1	299.93 (0.31)		837.15 (0.85)		0.035
MIG5	156.72 (0.29)		312.10 (0.57)		0.124
Married	892.84 (1.61)		601.50 (1.06)		0.760
Sect2, 3	564.29 (1.46)		519.44 (1.34)		0.436
Popden	-5.95 (2.52)	-0.200	-5.88 (2.49)	-0.198	167.73
Adj R <sup>2</sup>	0.0173		0.0223		Dist Moved
# of Observ.	679		679		= 4988.5

\* t-statistic

Distance Moved by Recent Movers  
- Cali 1978 -  
Within Barrio Moves Excluded

	Est. Coef.	Elasticities	Est. Coef. w/sq. terms	Elasticities	Mean Values
Constant	4783.31 (6.94)*		4119.95 (2.71)		
Y	-20.33 (1.97)	-0.094	-15.10 (0.52)	-0.077	11.42
Y <sup>2</sup>			-0.07 (0.22)		
Age	-28.88 (2.23)	-0.432	23.57 (0.33)	-0.281	37.14
Age <sup>2</sup>			-0.57 (0.72)		
FS	-5.54 (0.07)	-0.010	-227.77(1.02)	-0.117	4.27
FS <sup>2</sup>			18.69 (0.99)		
Worker	42.18 (0.28)	0.028	34.69 (0.21)	0.023	1.63
YRPVDU	43.38 (1.65)	0.059	37.26 (1.37)	0.051	3.39
Sex	-217.09 (0.46)		-212.62 (0.44)		0.233
Own	605.57 (1.61)		569.18 (1.48)		0.214
MIG1	-225.73 (0.23)		-159.18 (0.15)		0.019
MIG5	-646.88 (1.53)		-627.74 (1.47)		0.126
Married	418.68 (0.95)		528.55 (1.15)		0.709
Sect 3,4,5	-1023.30 (2.29)		-972.42 (2.15)		0.752
Popden	-3.22 (1.59)	-0.271	-3.47 (1.69)	-0.292	208.90
Adj R <sup>2</sup>	0.1264		0.1196		Dist. Moved
# of Observ.	206		206		= 2482.6

\* t-statistic

In each instance where a coefficient proves significant in the Bogota models, the associated sign is consistent with the cross-tabular expectation. Family size is positively associated (though to a decreasing degree) with longer move distances. The same is the case for the variable representing years in previous dwelling unit and the dichotomous variable reflecting whether or not the household owns the unit it lives in. In attempting to disentangle the effects of living in a disadvantaged sector from the population density of the sub-sector area within which a household had resided, both variables were introduced and were assumed to inhibit distance moved. In Bogota the population density variable performs as expected, and the "sector of origin" effect is not significant. Nothing useful is thus gained by excessive reliance on the locational disadvantage hypothesis.

In the case of Cali the variables with significant coefficients have signs that are also consistent with the cross-tabulations in all instances: the years in previous dwelling unit are positively associated with distances moved, while population density of the prior sub-sector of residence and the disadvantaged status of the prior residence sector are both negatively associated with distance moved. Household income and household head age also affect distance moved negatively, a tendency already detected in the cross-tabulations.

In all cases but one the two types of estimations yield the same signs for the untransformed variables in any given city. The exception is found in Cali, where the age of the household head is negatively associated with distance moved in the model without squared

terms and is positively associated with distance moved in the model with squared terms; only the first case has a significant coefficient.

Looking across both cities, and setting aside the above case, there are five instances out of twelve where coefficient signs differ. In four cases both sets of coefficients are insignificant. The remaining case, "origin in a disadvantaged sector" has a negative impact on distance moved in Cali and a positive, but insignificant, impact on distance moved in Bogota.

When elasticities (evaluated at the mean) and implied slope shifts are examined certain patterns emerge. Both Cali formulations produce similar elasticities and slope shifts except in one case (family size). For Bogota there is a basic similarity in results for the continuous variables; the dummy variable coefficients for the model with squared terms are generally higher, often considerably so, than in the formulation with only untransformed variables. Across these cities, there are two instances where the same variable is significant, namely "years in previous dwelling unit" and "population density". In these cases, the elasticities are almost identical.

What do the results tell us about the impact of these variables? The variables chosen have limited explanatory power, most clearly in Bogota. This suggests that city-specific factors probably play an important role in distance moved. The elasticities associated with the continuous and dichotomous variables, whose coefficients are significant, are all small, except in the case of "ownership of the current dwelling" in Bogota.

Across models and cities, the elasticities associated with years in previous dwelling hover around 0.05, while for population density they range from -0.2 to -0.3. The effect of family size is also quite small, roughly -0.1; this is also the general magnitude of the income effect. The age elasticity is only slightly larger, registering values of -0.4 and below. The slope shifts are generally 20% or less. In only one case is the coefficient significant and the associated shift large: the coefficient of the variable identifying homeowners in the Bogota model with squared terms implies a shift of 62% in the intercept.

In summary these models provide only a first cut at explaining distances moved. Nevertheless, it does appear that relocation distances are subject to a behavioral explanation and that a simplistic emphasis on any one factor, such as provided by a locational disadvantage hypothesis, is not a fruitful way to approach the issue in question.

#### Summary

When patterns of relocation are examined by ring, decentralization is evident in 1972 Bogota, though this is no longer true for 1978 Bogota or 1978 Cali. This is true whether households or population shifts are used. In all cases, reverse migration, from farther out to closer in rings is rare. Furthermore, most moves take place within the ring of origin.

This is consistent with the hypothesis that non-population serving employment is decentralizing in response to lower land costs in

the periphery, decreasing transport costs, and changing technology which encourages firms to search out lower priced land. The households whose workers are employed at those decentralized locations are obvious candidates for choosing outlying locations, where short work trips and lower cost housing is available. Other households, with heads working at more central locations, still move so as to trade off lower land costs for somewhat longer commutes. The shift in purchasing power to the periphery encourages population-serving jobs to decentralize, carrying with them yet other households who then move to the periphery.

The rings are very different in size and so heterogeneous in their resident household income characteristics that it proves difficult to examine the validity of hypothesis that individuals living in certain zones are "ghettoized" and face a "black hole" environment which bars moves to other zones in search of greater opportunities.

Some have thus suggested testing that hypothesis by looking at the radial sectors of these cities, which are more comparable in size and more homogeneous in terms of resident households incomes than the rings. When the relevant data is examined, it turns out that a majority or near majority of movers stay within their sector of origin.

It is difficult to decide exactly what phenomenon is at work. An examination of the inter-sectoral distribution of difference income groups with that of households as a whole suggests a strong pattern of upper-income self-segregation is at work in Cali and Bogota. Nevertheless it is true that sectors characterized as lower income often do have higher retention rates when only one move is considered. Longitudinal

data suggests that these high rates of retention do not persist when individuals are tracked over their entire period of residence in a city, and this may be the most important test of the "locational disadvantage" hypothesis.

High retention rates over one or more moves should not be viewed as the result of some market failure. The previously suggested hypothesis that a job-residence link exists can be verified with sector data. They show that a strong association exists between the employment site of the household head and the residence of that household.

Given the arbitrariness of sectoral boundaries and the absence of any measures of distance moved within neighborhoods, an attempt was made to model the determinants of inter-barrio moves. The results differ between Bogota and Cali. In Cali, household income, the age of the household head, and origination in a "disadvantaged" sector, all act to depress distance moved. Population density in the sub-sector of prior residence is negatively associated with distance moved in both cities; similarly, for both Bogota and Cali longer tenure in the prior dwelling unit adds to distance moved. Present homeowners in Bogota tend to move farther than their counterparts, while increasing family size is associated with longer moves.

When compared with the results of the estimation results, the cross-tabulations proved to be good predictors. In each instance where a coefficient proved to be significant, the associated sign was consistent with the cross-tabular expectation. Only two sets of cross-

tabulations produced unexpected results; neither the presence of a spouse in the household nor the migrancy status of the household head had significant coefficients in the multivariate analysis, even though some relationship was assumed from looking at the cross-tabular evidence.

#### SECTION IV. TENURE CHOICE BEHAVIOR

Among the more interesting issues in residential location analysis is the one dealing with tenure choice decision. The surveys in question allow one to analyze three options: owning, renting, or being a usufructuary. The latter, chosen by very few households (3%-6% depending on the survey), is collapsed into the renter category in the interest of economy. Also set aside is a modeling of the interlinkages between the various moving and location decisions. Households can be thought to be making a series of simultaneous or, at least, sequential choices. The decision to move is associated with a decision to own or rent, which is associated in turn, with a choice of location and a choice of space levels and other amenities to be consumed.

Isolating the tenure choice decision, then, allows one to explore the potential impact of several independent variables before undertaking any additional modeling effort. The variables explored here are those already used to categorize households. One that is conspicuously absent is "relative prices". That variable requires a fairly elaborate creation of implicit prices derived from the households' willingness to pay differing amounts for housing that has different attributes. Also absent are variables referring to changes in household characteristics or neighborhood attributes prior to the tenure choice decision. The data for such analysis, as noted before, simply do not exist.

For the variables examined, there are certain prior expectations about the nature of their impact on tenure choice. Household income is assumed to be positively associated with a decision to own. Ownership requires an investment of resources in the acquisition of assets (land, buildings) and/or construction materials and labor; this effort, in spite of the existence of do-it-yourself or autoconstruction mechanisms, opening up homeownership to poorer households, is presumably less burdensome as income increases, making homeownership more attractive. Implied in this is the assumption that homeownership is preferred over renting wherever income allows it because it provides not only consumption benefits but also the possibility of capital gains and an attractive rate of return on invested funds.<sup>1/</sup> There is in addition, the freedom to modify the quarters occupied as need arises, as well as to utilize housing space directly for income generating purposes, including the leasing of space or the establishment of business activities on the premises.

We know, for example, that owners are far more likely to rent out space to tenants than renters are to sub-lease space within their unit. The Bogota 1972 survey has no question which relates unambiguously to this issue,<sup>2/</sup> but the 1978 surveys reveal that in Bogota fully one-

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<sup>1/</sup> S. Bender argues that other investment options among such families are very poor and "many would not save were it not for the high return opportunity presented by self-contracted housing ..." See his "Low Income Housing Development and Income Distribution: The Impact of Growth and Change" in R.A. Berry and R. Soligo, Economic Policy and Income Distribution in Colombia, Boulder, Colorado, Westview Press, 1980, p. 257.

<sup>2/</sup> The only relevant question is one that asks about the presence of tenants or maids, but fails to separate out responses.

quarter of all homeowners and only 5% of all renters have tenants with their quarters. In Cali the respective rates are 18% and 7%. Furthermore, homeowners are more likely to have some household member who is part of the labor force and works at home. Roughly 28% of the owner households in 1978 Bogota have someone who fits that description; among renters the rate falls to 20% For Cali the respective proportions are 27% and 17%. Some of this difference derives from the ease with which portions of the dwelling space can be adapted to non-residential uses. Homeownership does bring with it associated transactions costs both prior to acquisition and later, when relocation is contemplated. Thus the assumed desirability of homeownership is not absolute; it may not suit the highly mobile, for example. Nevertheless, as a general rule, the expectation is that, as constraints are lifted in cities where good transportation links employment sites to developable raw land, homeownership will be favored.

One would also assume that homeownership is linked to the life-cycle features of the household. As a household head grows older, he or she can be expected to "settle down", changing jobs less frequently, <sup>3/</sup> facing the need to finance the greater space required to provide for a

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3/ The percentage of household heads working at a job for less than one year drops with age. In Bogota 1978 29% of the household heads 30 and under were so classified compared to 18% of those between 30 and 40 and 11% of those over 40. In Cali the relevant proportions are 25%, 18% and 10%.

growing household, <sup>4/</sup> responding to the income-growth induced demand for greater levels of amenities, <sup>5/</sup> and growing more concerned about asset accumulation. The very passage of time should also increase the household head's experience in dealing with location and housing issues, a factor which is important when a major investment (homeownership) is made.

For all the reasons, then, the age of the household head, the length of residency in the city, the marital status of the household head, and the size of the household are also presumed to be positively associated with a choice of buying rather than renting a house.

Corroborating the above hypotheses, one would expect that, once embarked on homeownership, a household would tend to hold to that choice to a far greater degree than would renter households facing a choice between renting and owning.

- 4/ Household sizes change very noticeably with age. In Bogota 1972 83% of the household heads 30 years of age or younger have 5 or fewer members, while the same is true for only 51% of those 31 to 40 and 43% for those heads over 40 years of age. In Bogota 1978, 90% of household heads 30 and under live in units with 5 or fewer members, compared to 64% of those between 30 and 40 and 55% of those over 40 years of age. In Cali 1978 the relevant proportions are 88%, 65% and 54%.
- 5/ In Bogota 1972, where income is expressed in interval form, only 31% of the households with heads 30 years or younger made more than 2000 pesos a month (the proxy value for median income. This increases to 42% for households with heads 31 to 40 and 48% for households with older heads. The reverse trend is apparent when the proportions earning less than 1000 pesos are examined. In Bogota 1978 the mean household income for households whose head was 30 or younger was 9745 pesos, compared to 12794 pesos for the group of heads 30 to 40, and 14945 pesos for those household heads who were older. In Cali 1978 the relevant values are 10,584 pesos, 10,885 pesos, and 11,714 pesos.

Two other variables are harder to develop priors about them. The sex of the household head should make a difference if a female household head suffers from inferior possibilities in the labor market at any given stage in its life cycle than its male counterpart; and if these possibilities inhibit asset accumulation.

Even less certain is the impact of the sector of origin when the decision is made to own or rent prior to a move.<sup>6/</sup> One extention of the already cited locational disadvantage hypothesis is that households originating in areas characterized by relatively low incomes would be bound by a series of constraints on their options, above and beyond their current income, which would make the search for housing to own more difficult than for their counterparts in better-off zones. This could occur because of the existence of discriminatory mechanisms which might limit access to or information about housing "bargains". With fewer options, then, the attractiveness of homeownership might be reduced.

#### Tenure Choice and Household Characteristics

Table IV-1 presents the tenure choices of all households classified by lower, intermediate, and higher incomes. While all three surveys (Bogota 1972, Bogota 1978, Cali 1978) reveal little difference between lower and intermediate income households, higher income households clearly

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<sup>6/</sup> This assumes, of course, that tenure changes are linked to relocation and, generally, cannot be made without moving.

Table IV-1

Tenure Choice by Household Income Categories

A. Bogota 1972

	<u>Household Income (pesos/month)</u>			
	<u>Up to 1000</u>	<u>1001-2000</u>	<u>Over 2000</u>	<u>Total</u>
Owner	33%	39%	57%	46%
Renter	67%	61%	43%	54%
Total	100%	100%	100%	100%

B. Bogota 1978

	<u>Household Income (pesos/month)</u>			
	<u>Up to 4000</u>	<u>4001-8000</u>	<u>Over 8000</u>	<u>Total</u>
Owner	33%	39%	57%	47%
Renter	67%	61%	43%	53%
Total	100%	100%	100%	100%

C. Cali 1978

	<u>Household Income (pesos/month)</u>			
	<u>Up to 3500</u>	<u>3501-7000</u>	<u>Over 7000</u>	<u>Total</u>
Owner	40%	43%	59%	51%
Renter	60%	57%	41%	49%
Total	100%	100%	100%	100%

opt for homeownership more frequently than their counterparts. Between a third and two-fifths of the households in the bottom two categories are homeowners. The highest rates, and smallest differences between these two groups, is found in Cali, where, even among the poorer households 40% are homeowners. Among the better-off in all three surveys, the rates of homeownership average between 57% and 59%. In all three cities, as noted in the introductory section, homeownership is characteristic of roughly one-half of all households. Income, then, does appear to influence tenure choice, though homeownership is present even among the poorest group of households.

For those that suspect that some relationship exists between the number of contributors to the household income and the tenure choice decision, the data in Table IV-2 is suggestive. Multiple worker households are always associated with higher levels of homeownership than single worker households. Unfortunately it is difficult to disentangle the forces at work in this relationship. Only 25% of the 1978 Bogota and Cali households have secondary workers who collectively contribute 50% or more of the household income.<sup>7/</sup> Even if one assumes that among these households the role of the secondary worker is crucial, the fact remains that cross-tabulations do not permit one to separate out the income effect from the multiple decision-maker effect. Correlation

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<sup>7/</sup> The 1972 survey does not allow an estimation of this proportion because all income is expressed in categories.

Table IV-2

Tenure Choice and the Number of Household Workers

A. Bogota 1972

Tenure Choice	Number of Workers	0	1	More Than 1	Total
		1	More Than 1	1	Total
Owner	60%	44%	59%	52%	
Renter	40%	56%	41%	48%	

B. Bogota 1978

Tenure Choice	Number of Workers	0	1	More Than 1	Total
		1	More Than 1	1	Total
Owner	49%	40%	53%	46%	
Renter	51%	60%	47%	54%	

C. Cali 1978

Tenure Choice	Number of Workers	0	1	More Than 1	Total
		1	More Than 1	1	Total
Owner	62%	40%	59%	51%	
Renter	38%	60%	41%	49%	

matrices used in the computations discussed below suggest, for example, that the number of workers is closely correlated with household income (.408 for Bogota 1978; .342 for Cali 1978) and with household size (.476 for Bogota 1978 and .511 for Cali 1978).

It is possible that an additional element is at work namely, the income tax and mortgage finance systems. Since this is a complex area and has not been studied as part of this research effort, only some hypotheses can be offered that would help explain the high rate of homeownership at the lower end of the income distribution and the moderate rate of homeownership at the upper end of the distribution.

1. Financial institutions have always faced regulatory restrictions on lending funds for housing, effectively cutting down on the ability of those considering the purchase of an expensive home to leverage their own resources.

2. The tax system deductions of interest and property taxes paid provide few incentives to those owning expensive homes because they face restrictions on the amount of mortgage funds they can borrow; their deductible interest payments are thus well below what they might be in the United States. Furthermore, property tax deductions are kept low because the property is valued at well below its market price in legal instruments like the property deed.

3. Renters can deduct a percent of their rent from their taxable income, while owners pay both an implicit rent income tax and a net wealth tax. This might act to discourage homeownership among those who have relatively little to gain from the associated interest and property

tax deductions. However, one should keep in mind that the rental deductions favor those with low rental payments; and that the burden of net wealth taxes and implicit rent income taxes are balanced by the presumed presence of widespread fraud in valuation of assets.

4. Capital gains forgiveness clauses have historically been as generous for non-housing as for housing assets, thus decreasing the attractiveness of housing as an investment for those with other options.

5. Other investment options are open to upper income households, including own businesses, with their generous deductions, and the possibilities of creative book-keeping. Overseas investments are another tax-avoidance mechanism open to the rich. The other income groups have no real alternatives to housing as an investment, and the deductions it brings, for savings or stocks are considered low-yield and/or poor risk options.

The validity and impact of each of the above statements is left for future research.

The life cycle variables also perform as expected. In all three cases, there is a rapid and very clear increase in homeownership as age increases (Table IV-3). Few households headed by individuals 30 years or younger own homes (20% or less). Among household heads 31 to 40 years of age, the rate of homeownership jumps dramatically, marking the apparent entry point into homeownership for most who will eventually acquire a dwelling. For this group, homeownership rates exceed 40% and approach 50%, the highest rates being associated with Cali.

Table IV-3

Tenure Choice by Household Head Age Category

A. Bogota 1972

	<u>Household Head Age</u>			<u>Total</u>
	<u>30 and Under</u>	<u>31-40</u>	<u>Over 40</u>	
Owner	20%	47%	66%	52%
Renter	80%	53%	34%	49%
Total	100%	100%	100%	100%

B. Bogota 1978

	<u>Household Head Age</u>			<u>Total</u>
	<u>30 and Under</u>	<u>31-40</u>	<u>Over 40</u>	
Owner	16%	41%	66%	47%
Renter	84%	59%	34%	53%
Total	100%	100%	100%	100%

C. Cali 1978

	<u>Household Head Age</u>			<u>Total</u>
	<u>30 and Under</u>	<u>31-40</u>	<u>Over 40</u>	
Owner	18%	48%	66%	51%
Renter	82%	52%	34%	49%
Total	100%	100%	100%	100%

Parenthetically it should be noted again that age is the only variable which automatically includes previous values; i.e. household heads in any age category were always younger in the past. It is thus the one variable which suffers least from the lack of information about changes over time.

Similarly (Table IV-4) length of residence in the city is important as an explanatory variable. A majority of long-term resident household heads are homeowners, while for those who arrived within five years prior to the survey the rate of homeownership hovers around 20%.

Household size is positively associated with homeownership (Table IV-5). Larger families (proxied here by households that exceed "the" mean of 5 members) have homeownership rates that, on average, exceed 60%, while the smaller counterparts average only about 40%. One can argue that the increasing household size that is associated with older household heads reinforces the postulated effect of age on the desire for assets. For growing households require increasingly larger amounts of residential space. Homeownership permits the consumption of housing space at lower out-of-pocket costs, once the initial investment has been made, than is possible through leasing. In fact, as noted below,<sup>8/</sup> the space consumed is higher, and the out-of-pocket costs as a percentage of income are lower, for owners than for renters of similar income levels, suggesting that the price facing owners is lower than that facing renters.

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8/ See Section V.

Table IV-4

Tenure Choice by "Recent Migrant" Status of Household Head

A. Bogota 1972

	<u>Household Head Status</u>		
	<u>Long Term Resident</u>	<u>Arrived Within Last 5 Years</u>	<u>Total</u>
Owner	56%	26%	52%
Renter	44%	74%	48%
Total	100%	100%	100%

B. Bogota 1978

	<u>Household Head Status</u>		
	<u>Long Term Resident</u>	<u>Arrived Within Last 5 years</u>	<u>Total</u>
Owner	50%	23%	47%
Renter	50%	77%	53%
Total	100%	100%	100%

C. Cali 1978

	<u>Household Head Status</u>		
	<u>Long Term Resident</u>	<u>Arrived Within Last 5 Years</u>	<u>Total</u>
Owner	56%	16%	51%
Renter	44%	84%	49%
Total	100%	100%	100%

Table IV-5

Tenure Choice by Household Family Size

A. Bogota 1972

	<u>Household Size</u>		
	<u>1 Through 5</u>	<u>Over 5</u>	<u>Total</u>
Owner	42%	63%	52%
Renter	58%	37%	48%
Total	100%	100%	100%

B. Bogota 1978

	<u>Household Size</u>		
	<u>1 Through 5</u>	<u>Over 5</u>	<u>Total</u>
Owner	38%	63%	46%
Renter	62%	37%	54%
Total	100%	100%	100%

C. Cali 1978

	<u>Household Size</u>		
	<u>1 Through 5</u>	<u>Over 5</u>	<u>Total</u>
Owner	41%	68%	51%
Renter	59%	32%	49%
Total	100%	100%	100%

Corroborating the above, one finds that households with a previous tenancy status of "owner" are far more likely to remain owners than renters are to continue leasing space. Fully three-quarters of the Bogota 1972 previous owners but only half of the renters chose to remain in the same category when they made a move. <sup>9/</sup> (Table IV-6). There is no similar data for 1978. As a proxy for individuals who were former renters one can look at household heads whose length of prior tenure was less than one year (Table IV-7). The evidence is suggestive if not very striking. Owners are more likely to have had previous tenures of over one year. For Bogota 16% of the renters had previous tenures of under one year, compared to 6% for owners. Nevertheless 84% of renters had prior tenures that exceeded one year. The data for Cali yields roughly the same conclusions.

The 1978 surveys allow one to examine the link between the length a household head has held his or her current job and the choice of tenure. As before, the variable is seen as a proxy for the degree to which the household head has "settled down" and is ready to make the commitment associated with a decision to buy property. Table IV-8 suggests that in both Bogota and Cali there is a tendency for owners to have worked longer at the same job than their counterparts. Fully 75% of the household heads with less than one year on the job are renters, compared to only half among those recording more time at the same establishment.

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9/ Unlike Section III, this section covers all households and not only those categorized as "recent movers."

Table IV-6

Present Tenure Choice by Prior Tenure Choice

A. Bogota 1972

Present Tenure Status		<u>Previous Tenancy Status</u>		
		Owner	Renter	Total
	Owner	75%	48%	52%
	Renter	25%	52%	48%
	Total	100%	100%	100%

B. Bogota 1978

N.A.

C. Cali 1978

N.A.

Table IV-7

Present Tenure Choice by Length of Previous Tenure

A. Bogota 1972

N.A.

B. Bogota 1978

	<u>Under 1 Year</u>	<u>1 Year and Over</u>	<u>Total</u>
Own	6%	94%	100%
Rent	16%	84%	100%
Total	11%	89%	100%

C. Cali 1978

	<u>Under 1 Year</u>	<u>1 Year and Over</u>	<u>Total</u>
Own	8%	92%	100%
Rent	18%	82%	100%
Total	13%	87%	100%

Table IV-8

Tenure Choice by Length of Time in the Present Job

A. Bogota 1972

N.A.

B. Bogota 1978

Tenure Choice	Length of Time in Job	<u>Under 1 Year</u>	<u>1 Year and Over</u>	<u>Total</u>
Owner		30%	48%	45%
Renter		70%	52%	55%

C. Cali 1978

Tenure Choice	Length of Time in Job	<u>Under 1 Year</u>	<u>1 Year and Over</u>	<u>Total</u>
Owner		26%	50%	46%
Renter		74%	50%	54%

The two Bogota cases reveal that female-headed households have rates of homeownership very close to the average for all households, while the Cali data shows female-headed households have higher than average homeownership rates (Table IV-9). There is no evidence that unusual factors are at work. For example, female-headed households rarely list "inheritance" as the way they acquired their unit. The 1972 Bogota survey reveals no information on the manner in which a unit was acquired. However, the 1978 Bogota data suggest that, among female-headed households, as among households headed by males, few units were inherited (5% versus 2% for males). Instead units were either bought (46%) or built for/by the household (47%). The figures for Cali are only marginally different from those for Bogota.

There is some contradictory evidence of an impact of marital status on the tenure choice decision when other factors are not controlled. Table IV-10 for example, suggests that in Bogota 1972 households where a spouse is present have marginally higher homeownership rates. In the Bogota 1978 data this gap widens perceptibly. For Cali 1978 there is no evidence of a "couples" effect at work.

The locational disadvantage hypothesis proves to be rather weak when confronted with data, (Table IV-11).

For Bogota 1972, there is only a narrow variation around the mean. It is true that the highest homeownership rate is recorded in a better-off sector (7) and the lowest are found in Sectors 2 and 3, characterized as poorer sectors. But the differences between the poorer and richer

Table IV-9

Tenure Choice by Household Head Sex

A. Bogota 1972

	<u>Household Head Sex</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>
Owner	53%	47%	52%
Renter	47%	53%	48%
Total	100%	100%	100%

B. Bogota 1978

	<u>Household Head Sex</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>
Owner	48%	45%	47%
Renter	52%	55%	53%
Total	100%	100%	100%

C. Cali 1978

	<u>Household Head Sex</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>
Owner	49%	55%	51%
Renter	51%	45%	49%
Total	100%	100%	100%

Table IV-10

Tenure Choice by Marital Status

A. Bogota 1972

Tenure Choice	Household Head Marital Status	With	Without	Total
		Spouse	Spouse	
Owner		53%	46%	52%
Renter		47%	54%	48%

B. Bogota 1978

Tenure Choice	Household Head Marital Status	With	Without	Total
		Spouse	Spouse	
Owner		49%	38%	46%
Renter		51%	62%	54%

C. Cali 1978

Tenure Choice	Household Head Marital Status	With	Without	Total
		Spouse	Spouse	
Owner		51%	50%	51%
Renter		49%	50%	49%

Table IV-11

### Tenure Choice by Sector of Origin of Previous Residence

A. Bogota 1972

B. Bogota 1978

C. Cali 1978

sectors are small: 50% versus 59%. A well-off zone, like Sector 8, has rates of homeownership (55%) not very different from that of an intermediate income area, like Sector 5 (54%), or the citywide average of 52%.

The 1978 Bogota data shows a greater degree of variability. Sector 7 again has the highest homeownership rates (57%) and, excluding Sector 1, the poorer zones, Sectors 2 and 3, have homeownership rates of 43% to 45%. While relatively low by comparison to Sector 7 (57%) they are very close to the citywide average of 48%. Once again Sector 8 has homeownership rates virtually indistinguishable from that of an intermediate area, Sector 4 (55%-56%).

In Cali, Sector 2, one of the better-off zones, has a high homeownership rate of 73%, but all other sectors are close to the citywide mean of 51% and an intermediate income sector (6) has a higher rate (62%) than the better-off Sector 7 (55%).

#### Modelling the Tenure Choice Decision

Following the logic explained in Section II, the cross-tabulations can be compared with the results generated by multivariate techniques, using OLS and LOGIT estimation procedures. For the sake of comparability, the OLS estimation was run on a randomly selected sub-sample to match the number of observations in the LOGIT computations; in the latter case, the restriction was imposed by memory storage requirements.

While the tenure choice model includes a "presence of tenants" dummy variable, it is otherwise specified in the same manner as the

Table IV-12

Estimation of the Tenure Choice Model < Bogota 1978 >

Comparison of OLS and LOGIT Estimation

	<u>OLS</u>	<u>1/</u>	<u>LOGIT</u>	<u>5/</u>	<u>Sample Mean</u>	<u>7/</u>
Constant	-0.713	(4.49) *	-1.664	(6.41)		
Income	0.005	(2.31)	0.007	(1.91)	12.30	
Income Squared	-0.00001	(0.38)	-0.00001	(0.14)		
Age	0.034	(4.68)	0.046	(4.21)	41.34	
Age Squared	-0.0003	(3.50)	-0.0004	(3.24)		
Family Size	0.058	(2.01)	0.088	(2.11)	4.92	
Family Size Squared	-0.004	(1.65)	-0.006	(1.77)		
Sex (F=1)	-0.075	(1.24)	-0.098	(1.15)	0.186	
YRPVDU <u>2/</u>	0.008	(2.83)	0.011	(2.75)	5.30	
YRJOB <u>3/</u>	0.007	(3.10)	0.009	(2.89)	6.08	
Number of Household Workers	-0.013	(0.68)	-0.014	(0.50)	1.72	
Tenants (Yes=1)	0.287	(6.24)	0.394	(5.49)	0.151	
Household Head Recent Migrant <u>4/</u> (Yes=1)	-0.105	(1.45)	-0.286	(2.27)	0.053	
Couples (Yes =1)	-0.049	(0.83)	-0.054	(0.65)	0.781	
Origin Sector (2,3, =1)	-0.018	(0.55)	-0.025	(0.53)	0.467	

Adj R <sup>2</sup>	0.2720	P0 = 0.474
Likelihood Ratio Index <u>8/</u>	0.2456	
Likelihood Ratio Statistics	248.5	
# of observations <u>9/</u>	730	730
% Correctly Predicted	71.64	73.15

\* t-statistic

Notes:

1. The OLS model has a dichotomous dependent variable where "1" represents "recent movers".
2. "Yrpvdu" equals "years in previous dwelling unit".
3. "Yrjob" equals "years in present job".
4. Recent Migrant (5) represents a household head who arrived between 2 and 5 years before the survey; more recent arrivals are denoted by Recent Migrant (1).
5. The LOGIT model estimates

$$L(P/1-P) = XB \text{ where}$$

$L(P/1-P)$  = log of odds that an event will occur;  $P$  = probability of event;  
 $X$  = independent variable vector; and  $B$  = vector of parameters,

6. LOGIT coefficients are made comparable to OLS coefficients using  
$$B_i P(1-P) = \frac{\partial P}{\partial x_i}$$
 where  $B_i$  is the LOGIT coefficient and  $P$  = probability of the variable at the mean.
7. Mean from OLS run.
8. The likelihood ratio index is equivalent to the  $R^2$  of the OLS model. The greater the value, the better the fit. A value above 0.2 is regarded as a good fit.
9. The number of observations was chosen using a random number generator.

Elasticities for Tenure Choice Model < Bogota 1978 >  
Comparison of OLS and LOGIT

	<u>OLS</u>	<u>LOGIT</u>
Income	0.123	0.175
Age	0.802	1.128
Family Size	0.193	0.301
YRPVDU	0.089	0.123
YRJOB	0.090	0.115
Number of Household Workers	-0.047	-0.051

Table IV-13

Estimation of the Tenure Choice Model <Cali 1978>  
Comparison of OLS and LOGIT Estimation

	<u>OLS</u>	<u>1/</u>	<u>LOGIT</u>	<u>5/</u>	<u>Sample</u>
					<u>Mean</u>
Constant	-0.573	(3.49) *	-1.372	(5.60)	
Income	0.009	(2.57)	0.011	(2.44)	11.50
Income Squared	-0.0001	(2.39)	-0.0001	(2.18)	
Age	0.024	(3.25)	0.030	(2.88)	42.65
Age Squared	-0.0002	(1.96)	-0.0002	(1.76)	
Family Size	0.100	(4.09)	0.129	(3.73)	4.91
Family Size Squared	-0.005	(2.57)	-0.006	(2.28)	
Sex	0.057	(0.99)	0.087	(1.10)	0.245
YRPVDU <u>2/</u>	0.011	(3.73)	0.016	(3.48)	4.49
YRJOB <u>3/</u>	0.002	(1.09)	0.003	(0.99)	6.16
Number of Household Workers	-0.035	(1.88)	-0.043	(1.72)	1.72
Tenants (Yes=1)	0.150	(3.04)	0.201	(2.91)	0.127
Household Head					
Recent Migrant (5) (Yes=1)	-0.171	(2.53)	-0.285	(2.72)	0.065
Couples (Yes=1)	-0.006	(0.12)	-0.0007	(0.00)	0.702
Origin Sector (3,4,5=1)	-0.076	(1.96)	-0.103	(1.96)	0.737
Adj R <sup>2</sup>		0.2397			P0 = 0.535
Likelihood Ratio Index <u>8/</u>			0.2139		
Likelihood Ratio Statistics			220.1		
# of Observations		742		742	
% Correctly Predicted		72.10		74.26	

\* t-statistic

Notes:

1. The OLS model has a dichotomous dependent variable where "1" represents "recent movers".
2. "Yrpvdu" equals "years in previous dwelling unit".
3. "Yrjob" equals "years in present job".
4. Recent Migrant (5) represents a household head who arrived between 2 and 5 years before the survey; more recent arrivals are denoted by Recent Migrant (1).
5. The LOGIT model estimates

$$L(P/1-P) = XB \text{ where}$$

$L(P/1-P)$  = log of odds that an event will occur;  $P$  = probability of event;  
 $X$  = independent variable vector; and  $B$  = vector of parameters,

6. LOGIT coefficients are made comparable to OLS coefficients using  
$$B_i P(1-P) = \frac{\partial P}{\partial x_i}$$
 where  $B_i$  is the LOGIT coefficient and  $P$  = probability of the variable at the mean.
7. Mean from OLS run.
8. The likelihood ratio index is equivalent to the  $R^2$  of the OLS model. The greater the value, the better the fit. A value above 0.2 is regarded as a good fit.

Tenure Choice Model <Cali 1978>  
Comparison of OLS and LOGIT Elasticities

	<u>OLS</u>	<u>LOGIT</u>
Income	0.144	0.187
Age	0.553	1.032
Family Size	0.467	0.643
YRPVDU	0.092	0.134
YRJOB	0.023	0.035
Number of Household Workers	-0.113	-0.138

probability of move model. The OLS and LOGIT estimations for both cities (Tables IV-12 and IV-13) share a common characteristic: most variables have coefficients whose values are similar in magnitude but opposite in sign to those found in the probability of move model. Differences exist primarily in the significance levels of some of the coefficients. This overall similarity suggests that the probability of move and tenure choice decisions are tied to the same underlying phenomena tugging in opposite directions. Household characteristics that are positively associated with household mobility are negatively associated with the decision to own.

The nature of the relationship between homeownership and various household characteristics is generally the same whether cross-tabulations or multivariate analysis is used. One exception involves the impact of an increase in the number of workers on the household's decision to own, the cross-tabular results suggests a positive relationship while the estimations point to a negative link. As before, it is likely that the interaction between family size and the number of workers is responsible for the nature of the cross-tabulation.<sup>10/</sup> Another exception involves the apparent positive association between Bogota household heads living with a spouse and homeownership. This is suggested by the cross-tabulations but denied by the multivariate estimations, which find no significant relationship.

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10/ The association between these two variables in the correlation matrix is 0.462 (Bogota) and 0.508 (Cali).

The OLS and LOGIT models differ in the coefficient signs only once across both cities. The sex of the household coefficient is positive in Bogota and negative in Cali, though insignificant in all four estimations.

Two sets of variables have coefficients whose values are not significantly different from zero in both estimations across both cities. The first is the cited "sex of household head" variable. The second is the marital status of the household head. Elsewhere neither Bogota estimation finds a "number of workers" or a "disadvantaged sector of origin" effect. In Cali the variable "years at job" has an insignificant coefficient in both formulations.

Other than those cited, all variables are significant in both cities. Furthermore the LOGIT and OLS coefficients are similar in magnitude within and across cities, suggesting a similarity in tenure choice behavior. Finally the overall performance of the models is similar in terms of variance explained and of percent correctly predicted.

Except for the income term in Bogota, the variables "income", "age", and "family size" have significant second order terms and are thus associated in a non-linear manner with tenure choice in both estimations for Bogota and Cali. Unlike the earlier results in the probability of move model, these three variables have a positive impact on ownership. The elasticities for income are almost identical for Bogota and Cali, regardless of estimation procedure, hovering between 0.1 and 0.2, being higher in each case in the LOGIT procedure. Family size effects are somewhat higher in Cali than in Bogota, ranging from 0.5 to 0.6 in the first case and 0.2 to 0.3 in the latter.

Far higher are the elasticities associated with the age of the household head. In the OLS formulations the elasticities range from 0.6 (Cali) to 0.8 (Bogota), while in the LOGIT estimations they equal 1.0 (Cali) and 1.1 (Bogota). These very high elasticities probably reflect the cited weakness in the financial markets, which thus place great pressure on own-accumulation over time as a precondition for the expenditures needed to achieve homeownership.

Among the remaining continuous variables, the measures of stability, such as "years in present job" and "years lived in previous dwelling" are positively associated with the probability of homeownership, though the elasticities in each case tend to be small (0.1 or less) and the job tenure measure is insignificant in Cali. The "workers in household" variable is significant in Cali but not in Bogota; in both cases low elasticity values of -0.1 are reported.

Using Bogota data, the only dummy variable that is significant in both formulations is "tenants". That variable is also significant and positive in Cali. The coefficients imply upward shifts in the slopes of 24% (LOGIT) to 40% (OLS) in Bogota and 15% (LOGIT) to 26% (OLS) in Cali. This confirms the cross-tabular results and is consistent with the hypothesis that the financial requirements of homeownership combined with the flexibility that comes from controlling the unit encourage income-generation uses of the residence.

Another dummy variable proves significant in all but the Bogota OLS case: recent migrancy status for household heads. Recent arrivals apparently lack the experience necessary to move easily into a real estate investment. The associated downward slope shift is of roughly 15% in Bogota and 21% (LOGIT) to 30% (OLS) in Cali, magnitudes not very different from those found in "tenants" case.

As suggested by the cross-tabulations, Bogota provides little evidence of a link between previous sector of residence and tenure choice, while in Cali a weak association is clear in all cases. Among Cali households, those originating in Sectors 3, 4 and 5 are less likely to own; the coefficients imply a slight downward shift in the respective slopes of 8% (LOGIT) to 13% (OLS).

In sum, the use of a LOGIT model fails to add greatly to what is learned with the simpler OLS formulation. The cross-tabular findings tend to predict quite faithfully the direction of impact of most variables, though they fail, as before, to perform well in separating significant from insignificant variable coefficients. Finally it bears repeating that the similarities of the results for the two cities stand out as a major conclusion of this section.

Summary

Though some variables of interest are simply not available (such as relative prices), it is possible to model the tenure choice behavior of households.

The probability of ownership is enhanced by rising household income, the aging of the household head, growing household size and the two indexes of household "stability" (length of time in previous dwelling, length of time the household head has spent in the present job). Other variables such as the number of workers contributing to the household income, the recent arrival of the household head to the city, and location in a lower-income sector of the city prior to the most recent move, all tend to reduce the probability that the household will own.

Variables such as the sex or marital status of the household head play no apparent role in the tenure choice decision.

The results for Bogota and Cali are roughly similar in coefficient sign, significance and value. The introduction of LOGIT estimation procedures tend to produce coefficients with slightly larger coefficient elasticities and to lead to the classification of fewer variables as significant.

The cross-tabulations perform quite well in predicting the type of relationship to be expected between tenure choice and the variables under consideration. In only two cases, the impact of secondary workers on the probability of owning and (for Bogota) the role of marital status, did the cross-tabulations provide misleading results.

SECTION V. CHARACTERISTICS AND DETERMINANTS OF RESIDENTIAL SPACE  
CONSUMED BY SURVEYED HOUSEHOLDS

Given the choice of tenure, what are some of the features of the space occupied by Bogota and Cali households? Does the space consumption follow a pattern, varying according to the different characteristics of the households? These two questions summarize the issues of interest in this section of the study.

Some General Characteristics of Space Consumption in Bogota  
and Cali

It is possible to review the evolution of space consumption by households in Bogota and the cross-sectional differences between Bogota and Cali. Unfortunately the 1972 survey collected no information on square meters of occupied space, thus the comparisons between the two points in time are based on the number of persons per room, where the latter unit is not necessarily constant in size. Nevertheless, the information available provides some insights.

<sup>1/</sup>  
If households are classified as owners or renters, and further categorized by income, it is clear, from Table V-I that both household size and rooms occupied varies by tenure and income. Low income owners in Bogota, 1972, have larger households than their renter counterparts; on average this amounts to an extra member (5.5 vs. 4.5). The same owners have more rooms per households (2.3 vs. 1.5) than the

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1/ For the sake of simplification, usufructuaries are ignored.

Table V-1: Mean Number of Persons Per Household Room,  
by Income and Tenure Characteristics

A. Bogota 1972

	a <u>Mean No. Persons Per Household</u>	b <u>Mean No. Rooms per Household</u>	a/b = c <u>Mean No. Persons Per Room</u>
Low Income <sup>1/</sup> Owners	5.5	2.3	2.4
Low Income Renters	4.5	1.5	3.1
All owners	6.4	3.7	1.7
All Renters	5.3	2.4	2.2

B. Bogota 1978

Low Income <sup>2/</sup> Owners	4.3	2.8	1.5
Low Income Renters	3.6	1.6	2.2
All owners	5.6	4.2	1.3
All Renters	4.2	2.5	1.7

C. Cali 1978

Low Income <sup>3/</sup> Owners	4.4	2.6	1.7
Low Income Renters	3.4	1.7	2.1
All Owners	5.5	3.9	1.4
All Renters	4.2	2.5	1.7

1/ Households earning less than 1000 pesos a month.

2/ Households earning less than 4000 pesos a month.

3/ Households earning less than 3500 pesos a month.

low income renters and thus the mean number of persons per room in owner households is marginally lower than in renter households (2.4 vs. 3.1). When all owners and renters are compared the relative rankings remain the same, though in each case there are larger households, more rooms, and, on average, fewer persons per room than in the low income comparisons. Owners as a group contain 1.7 persons per room while renters have a higher 2.2 persons per room.

The Bogota 1978 data maintains the rankings established in 1972 except that households are uniformly smaller by about 1 member, regardless of category. Except for the "all renter" category, where the mean number of rooms remains the same, the different types of households occupy more rooms, on average. The increase is equivalent to 20% for low income owners, 9% for low income renters and 14% for all owners. As a result, there is a measurable improvement, led by the low income owners, in the "number of persons per room" variable. Low income households in 1978 register a crowding index only 65% of that in 1972, while low income renters live in housing that is only 73% as crowded as in 1972. Among all owners and renters the 1978 level is 78% that registered in 1972.

The values for Cali are very similar, by category, for both household size and for mean number of rooms per households. By the measure of crowding utilized here, Cali and Bogota are almost indistinguishable, regardless of the tenure-income combination examined.

For 1978, it is possible to supplement the previous analysis with information on square meters of space consumed (Table V-2). The patterns already discussed emerge anew. Owners occupy more space than renters, whether viewed as a whole or within categories like "low income". Low income households are smaller in size than the average for each overall category, and their space utilization is also smaller.

In Bogota low income owners occupy units of somewhat less than 100 square meters, while poor renters utilize less than half that amount. Owners, taken as a group, use a mean 151 square meters of space, while renters, again, consume somewhat less than half that amount. Since owner households are larger, the differences in square meters per person are less dramatic, though still large. Among low-income households, owners occupy 23 square meters per person or 95% more than renters.

Table V-2: Mean Number of Square Meters Per Person  
by Income and Tenure Characteristics

A. Bogota 1978

	a Mean Number Persons per Household	b Mean Square Meters per Household	<sup>a/b = c</sup> Mean Square Meters per Household
Low Income <sup>1/</sup> Owners	4.3	99	23
Low Income Renters	3.6	42	12
All Owners	5.6	151	27
All Renters	4.2	72	17

1/ Households earning less than 4000 pesos a month

B. Cali 1978

	a Mean Number Persons per Household	b Mean Number of Square Meters per Household	<sup>a/b = c</sup> Mean Square Meters per Person
Low Income <sup>2/</sup> Owners	4.4	70	16
Low Income Renters	3.4	36	11
All Owner	5.5	118	21
All Renters	4.2	67	16

2/ Households earning less than 3500 pesos a month

Among households in the aggregate, owners consume 27 square meters per person or 58% more space than their renter neighbors.

The self-same pattern emerges in Cali, where less space is occupied by households, on average, than in Bogota, even after adjusting for the slightly smaller household size. Owner households, with an average 21 square meters per person, occupy 33% more space than renter households. Among the poor, the differential increases, as owners, with 16 square meters per person, use 49% more space than renters.

#### Characteristics of Autoconstruction Owners

The 1978 data also provide information on an interesting sub-category of owners, namely those who are involved in auto-construction. The latter term applies, in a loose sense, to households who acquire raw land in areas peripheral to existing development from entrepreneurs who subdivide rural estates. While the legal framework in place specifies that detailed and costly improvements should accompany this subdivision, this is generally bypassed and the sale may or may not be accompanied by the provision of infrastructure and the provision of green spaces in the new community. Falling outside authorized norms, the development area is labelled variously as "clandestine" and "pirate", though it is hidden only from those who wish not to see it.<sup>2/</sup>

Households in these neighborhoods build structures at a rate that depends on their means, beginning with as little as a shack made of discarded materials, followed by a room within a walled area that both delineates the property and allows for the safe stockpiling of building

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<sup>2/</sup> For a more detailed look, see A. Hamer, Bogota's Unauthorized Subdivisions, Washington, Urban and Regional Report #81-19, Urban and Regional Economics Division, Development Economics Department, Development Policy Staff, The World Bank, August 1981.

materials. Thereafter room is added to room and one story upon another until a finished house emerges, with one to three floors. The process, while having a definite "do-it-yourself" air, does not rely solely on the unpaid labor of family and friends. Depending upon the degree of difficulty involved and the household's income, certain stages are built with paid, presumably more skilled labor.<sup>3/</sup> The reference to auto-construction is now so accepted that a more accurate but cumbersome substitute label is not useful, as long as the reader understands the nature of the process involved. This provides households of limited means with the possibility of becoming first-time homeowners even though their income profile and mean incomes differ substantially from that of the owner group as a whole.

Table V-3 and V-4 help illustrate this point. In both Bogota and Cali, half of the households, roughly speaking, occupy units with fewer than 75 square meters, while no more than 15% (Cali) to 22% (Bogota) consume more than twice that amount. Owners, in the aggregate do better. In Bogota each space category (under 75 square meters, 76-150 square meters; over 150 square meters) contains approximately one-third of all owners, in Cali the first two categories account for roughly 40% of the households, with the remaining fifth in the final and largest space grouping. Owners consistently outperform the "all households" category both in the distribution of income (with above average propor-

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3/ S. Bender reports that 35% of the labor hours required for construction involve specialized skills. See his "Low Income Housing Development and Income Distribution: The Import of Growth and Change" in R.A. Berry and R. Soligo, Economic Policy and Income Distribution in Colombia, opcit, p. 255.

Table V-3: Household Space Consumption Profile of All Owners, Auto-Construction Owners, Renters, and All Households

A. Bogota 1978

Area (in $m^2$ ) occupied by household	All Owners	All Auto-Construction Owners	All Renters	All Households 1/
75 and less	31	46	69	52
75 + 150	33	35	20	26
150+	35	19	10	22
Mean Area per Household ( $m^2$ )	151	106	72	109
Mean Persons per Household	5.6	5.9	4.2	4.8
Mean area/person	27	18	17	23

B. Cali 1978

75 and less	38	49	68	53
75+ - 150	40	45	24	32
150+	21	6	8	15
Mean area (in $m^2$ ) per household	118	81	67	92
Mean number of persons per household	5.5	6.2	4.2	4.8
Mean area/person	21	13	16	19

1/ Includes usufructuaries

Table V-4: Income Profile of All Owners,  
Auto-Construction Owners, Renters, and All Households

A. Bogota 1978

(Pesos/Month) Income Categories	All Owners	All Auto- Construction Owners	All Renters	All Households <sup>1/</sup>
Low Income (4000 and less)	17	25	28	24
Middle Income (4000+ - 8000)	23	31	33	28
High Income (8000+)	59	44	39	48
Mean Labor + non- Labor Household Monthly Income in Pesos	14,862	9,350	10,816	12,529
Total Number Households in Each Category	328,007	106,416	338,822	708,691

Note:  $\frac{\# \text{ Autoconstruction owners}}{\# \text{ All owners}} \times 100 = 32\%$

B. Cali 1978

Low Income (3500 and less)	17	26	22	21
Middle Income (3500+ - 7000)	29	34	37	33
High Income (7000+)	54	39	41	46
Mean Labor + Non- Labor Household Monthly Income in Pesos	12,122	7,735	9,526	10,665
Total Number of Households in Each Category	109,565	37,752	93,350	216,706

Note:  $\frac{\# \text{ Autoconstruction owners}}{\# \text{ All owners}} \times 100 = 34\%$

<sup>1/</sup> Includes usufructuaries

tions in the "better-off" category and below average proportions in the "poverty" category) and in the per person use of space. Their mean incomes, like their space consumption per capita, exceed that of all households, by 12%-13% in Cali and 18%-19% in Bogota.

Autoconstruction owners, who at the time of the survey accounted for roughly one-third <sup>4/</sup> of all owners in both cities, have below average mean incomes and, in fact, earn 15%-20% less, on average, than renters. Yet their consumption of space per capita actually exceeds that of renters in Bogota, while falling below the latter in Cali by about 20%. Autoconstruction owners have a measured income distribution which puts roughly <sup>5/</sup> a fourth in the bottom income class, a proportion not very different from that of all renters and about the same (Bogota) or worse (Cali) than households as a whole. Nevertheless, fewer than half of the autoconstruction households live in structures with 75 square meters or less, while almost 70% of the renters in both cities and over half of all households live in small units. Their aggregate similarity to all renters on a per capita basis (in the case of Bogota) and their below-average per capita performance, compared to all households, comes from the overrepresentation of autoconstruction households in the intermediate space category and their underrepresentation in the space intervals exceeding 150 square

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4/ The surveys were directed at households and not their structures. Thus this information says nothing about whether or not a given structure was originally built by its first owner and then sold. Since evidence exists that these units are sold there is nothing contradictory between the cited estimate and others which suggest higher proportions of units in any given time span being build by auto construction households.

5/ Under 4000 pesos per month for Bogota households and under 3500 pesos for Cali households.

meters. In addition their per capita performance is depressed by the usually large size of the households, averaging around 6 members compared to fewer than 5 for the all households and a little over 4 for all renters, in both cities. Among the poor, homeowners account for one-third of the households in Bogota and 41% of the households in Cali.<sup>6/</sup> From a social point of view it is important to note that among these poorer households half can be identified as first-time occupants of autoconstructed housing. Even among those poorer homeowners who did not build their own house, autoconstruction was probably important as a supplier of previously-owned housing. Thus a healthy 37% of poorer homeowners in Bogota and 25% in Cali report buying their houses, a fact which, given the price of conventional housing and the limited supply of the latter, suggests that, indirectly, autoconstruction units account for about 75%-80% of the housing that is consumed by the owner poor.

Table V-5 suggests two additional facts. These households, if the surveys are to be believed, are almost entirely provided with all basic utilities (water, power, and sewer). The proportion approaches (Cali) or exceeds (Bogota) 90%; this differs little from the average of 96% for all households. By one measure, therefore, these clandestine developments are thus no longer located in deprived neighborhoods, though they may well have lacked these amenities at the time of construction.

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6/ The various proportions in this paragraph are derived from the data base presented in Table V-4.

Table V-5: Miscellaneous Characteristics of  
Auto-Construction Owner Households

A. Bogota 1978

Categories	All Auto-Construction Owners	Poor Auto-Construction Owners	All Owners Excluding Auto Const.	All Households <sup>1/</sup>
% Units with Water, Sewer, Power	90.8%	79.8%	97.8%	95.8%
% Units with Roomers	37.1%	32.3%	20.0%	14.5%
% Households with Member in Work Force and Working at Home	26%	17%	34%	25%

B. Cali 1978

% Units with Water, Sewer, Power	87.8%	88.2%	98.4%	96.0%
% Units with Roomers	22.5%	37.6%	15.2%	12.3%
% Households with Member in Work Force and Working at Home	17%	16%	33%	27%

1/ Includes usufructuaries

In another respect these households do differ from other owners and all households, generally. A substantial portion of autoconstruction households depend on the rental of space to tenants to augment their income. We have no direct measure of the additions to base income represented by these activities, but indirect indicators do exist. Fully 37% of Bogota's autoconstruction households and 23% of Cali's have rent-paying tenants, helping to explain the fact that in both cities the number of households per dwelling among autoconstruction owners exceeds the average for all owners. By contrast, fewer than 20% of other owner households and of all households, generally, are likely to rent out space to tenants within their dwellings in these two cities.

Autoconstruction households also use their dwellings to house labor force members working at home, though in this case, the rate is lower than among other owners and all households. Seventeen to 26% of the autoconstruction households have workers working at home, compared to 33%-34% among other owners and 23%-25% among all households.

In general, then, the building of their own house represents much more for these households than investment in an asset whose flow of services can be consumed; it represents an important way to augment household income.

The autoconstruction households, like other owners, receive the imputed income from their investment in housing (Table V-6). This amounts to an average addition of 31%-32% to the measured income of intermediate income households and 17% to 22% to the measured income of above-median income households, after deductions for out-of-pocket

Table V-6: Shelter Costs by Household Income and Tenure Type

A. Bogota 1978

	Rent/Income (A)	Imputed R/Income (B)	Mortgage/Income (C)	Utilities/Income (D)
Poor <sup>1/</sup> Renters <sup>2/</sup> (62 square meters)	55%	-	-	81%
Intermediate Renters (74 square meters)	34%	-	-	6%
Rich Renters (133 square meters)	21%	-	-	3%
Poor AC <sup>3/</sup> (82 square meters)	-	53%	4%	14%
Intermediate AC (86 square meters)	-	31%	55%	6%
Rich AC (134 square meters)	-	22%	3%	3%
Poor Other Owners (102 square meters)	-	78%	16%	12%
Intermediate Other Owners (114 square meters)	-	49%	11%	8%
Rich Other Owners (199 square meters)	-	24%	7%	3%

1/ Excludes households with less than 500 pesos/month

2/ Excludes households whose rent includes use of utilities

3/ Auto-construction households

B. Cali 1978

Poor <sup>1/</sup> Renters <sup>2/</sup> (61 square meters)	57%	-	-	12%
Intermediate Renters (74 square meters)	32%	-	-	7%
Rich Renters (128 square meters)	17%	-	-	3%
Poor AC <sup>3/</sup> (72 square meters)	-	59%	3%	9%
Intermediate AC (78 square meters)	-	30%	1%	6%
Richer AC (91 square meters)	-	17%	1%	3%
Poor Other Owners (83 square meters)	-	85%	15%	16%
Intermediate Other Owners (82 square meters)	-	43%	6%	7%
Richer Other Owners (167 square meters)	-	21%	5%	3%

1/ Excludes households with less than 500 pesos/month

2/ Excludes households whose rent includes use of utilities

3/ Auto-construction households

costs like mortgages (which are rare) and imputed property taxes (whose collection among these households is not a subject probed by the survey).

By contrast, intermediate and upper income renter households spend almost exactly the same proportion of their income on rental payments for (with one exception)<sup>7/</sup> the same amount of space or less. While not wishing to minimize past sacrifices in consumption required to reach this happy state of affairs, the autoconstruction owners are able to house themselves at minimal out-of-pocket costs, earn imputed income and gain new sources of income from the housing unit turned workplace and/or mini rooming house. A small extra cost, of 6% of income among the intermediate income households and of 3% among the better-off, brings these households (and their renter counterparts) the benefits of water, sewer, and light.

In this review of Table V-6 one should note the presence of one set of troubling statistics. Poor renters, poor autoconstruction owners, and other poor owners have rent- or imputed rent-to-measured income ratios which are absurdly high, averaging 50%-60% among the first two categories and roughly 80% among the latter. An examination of the very poorest households, however defined, suggests that the reported monthly income question in the survey ("Did you receive some income

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7/ In Cali, the better off renters do consume more space, on average, than their autoconstruction counterparts. It should be noted that in this discussion the renters are comparable to non-renters in that they pay for their own utilities. Renters whose utilities are included in the rent payment appear to be roomers, for their consume a mean 25-40 square meters, instead of the over 100 square meters reported by other renters.

last month from the following types of sources: .... How much did you receive from each?) does not represent the "permanent income" of these units. Among all poor renters, for example, rent is a large multiple of income, a situation that is unsustainable in the long run. Among all Bogota poor renters, the mean measured income for those reporting 500 pesos or less, for example, is 16 pesos(!), while among the same group in Cali the mean is 91 pesos. Mean rent in each case is 4002 and 2263

<sup>8/</sup> pesos. Thus great care should be taken in deriving rent (or imputed rent) to income ratios for the very poor, most of whom are underreporting their typical incomes (though, given the high income coverage of the survey, not necessarily underreporting their previous month's income). Needless to say, the attempt to model various forms of behavior throughout the text as a function of income is, by extension, very problematic when one is forced to include these households to avoid truncating the sample results. As an analytical problem, this one is troubling and insoluble without the collection of income data averaged over several months.

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<sup>8/</sup> This discussion is for renters who pay for utilities separately. Slightly smaller discrepancies prevail for those whose rent includes utilities and who appear to be renting rooms from others.

Household Space Consumption and its Determinants

One would expect that, like tenure choice, household space consumption would tend to reflect the work of independent variables characterizing the household unit. Households with higher incomes would presumably consume more of all but "inferior" goods and therefore housing consumption should vary positively with income.<sup>9/</sup> The presence of multiple workers might act to increase the demand for space, independent of an income effect or it might reflect the constrained resource circumstances of the household, where economy in space consumption is characteristic, when compared to households with similar incomes but only one worker. Younger household heads having less income and fewer assets, being more uncertain about their income flows and having smaller households, would be expected to consume less space.<sup>10/</sup> The impact of the sex of the household head is difficult to predict a priori, except to speculate that the lower incomes of female headed households might reduce space consumption relative to male-headed households. At the same time, female-headed households have high homeownership rates, suggesting asset levels not indicated by income levels. One must look to the data for guidance in this case, especially with regard to owner households. Other things being equal, household size should be positively related to space consumption; for households may be assumed to prefer equal or decreasing levels of crowding as more members are added to the household. This is all the more likely

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<sup>9/</sup> Households, of course, consume a bundle of housing services, of which space is only one dimension. It may be traded-off against other features and therefore not vary linearly with income.

<sup>10/</sup> Younger households (heads 30 and under) have higher proportions in the poverty categories than all other age groups except the very oldest (heads over 60 years of age). The younger households also have the lowest rates of homeownership, with 20% or less owning their dwellings. They have relatively higher levels of job changes in the year preceding the survey. Their households are small, with up to half recording 3 or fewer members.

because household size varies positively with age of the household head, and the latter is, in turn, positively correlated with increases in income and assets. Weaker arguments could be made for the positive impact on housing consumption of the presence of a spouse, which correlates with increasing household size and the age of the household heads.<sup>11/</sup> Recent migrants to the city are known to have lower incomes than their counterparts.<sup>12/</sup> They have, as well, relatively young household heads and are thus hypothesized to behave in the manner described above, i.e. to consume housing in quantities that are below average. Finally, there is the possibility that the previous sector of residence had an impact on space utilization independent of other household characteristics, like income. Cross-tabulations bearing on the former provide weak evidence even if they should appear, superficially, to bear out the hypothesis of locational disadvantage, for clearly "other things" are not equal; in particular the income profiles of the households originating in each sector may differ considerably.

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<sup>11/</sup> Older households are somewhat more likely to have spouses, except at advanced ages, but even the younger household heads have spouses in most cases. Households with spouses present are definitely larger than those without. Over 43% of the Bogota 1972 spouseless households have 3 or fewer members, while only 16% of those with spouse can be so classified. The data for 1978 is broadly consistent with this finding. Fifty-seven percent of the Bogota 1978 spouseless households and 49% of similar Cali households have 3 or fewer members. The proportions for households with spouses present is 21% and 26%, respectively.

<sup>12/</sup> See section I for a discussion of the characteristics of migrant-head households.

The Cross-Tabular Evidence Reviewed: Owner Households

Given the very different amounts of space consumed, on average, by owners and renters, and given the fact that owners and renters consume different bundles of attributes,<sup>13/</sup> it is useful to discuss the results of the cross-tabulations by tenure choice.

Owner households both in Bogota and Cali have aggregate incomes above those of their renter counterparts. The mean income of 1978 renter households is only 73% that of homeowner households in Bogota while it is 78% in Cali. Furthermore, 59% of all 1978 Bogota owners, but only 39% of Bogota renters earn household incomes that lie above the city median; in Cali the relevant proportions are 54% and 41%.

Income does seem to be a key explanatory variable among owners (Table V-7). In both Cali and Bogota, poor owner households (with incomes at or below one-half the median) occupy half the housing space, on average, associated with households who earn more than the median income. Thus, while income may play a secondary role in the tenure choice decision, it appears to be a crucial variable in the determination of space consumption.

The presence of secondary workers in the households also seems to affect space consumption positively. Among Bogota owner households, those with secondary workers consume, on average, 165 square meters of space, compared to 133 square meters where only one worker is present. In Cali, the association is similar: where multiple workers are present, space utilization averages 136 square meters; where only one worker is reported, the total drops to 94 square meters.

13/ Owners make housing choices, at least in part, as investors. Furthermore, work with housing expenditures and associated housing attribute data suggest that, all other things being equal, tenure choice still is the significant additional variable.

Table V-7: Household Space Consumption According to Selected Characteristics of Owner Households

I. Income of Household

A. Bogota 1978

	Space in Sq. Meters	75 or less	76-150	Over 150	Mean Area Occupied
<b>Income</b>					
4000 or less		53	30	17	99
4000-8000		50	33	17	103
Over 8000		18	34	48	182
Total		31	33	35	149

B. Cali 1978

	Space in Sq. Meters	75 or less	76-150	Over 150	Mean Area Occupied
<b>Income</b>					
3500 or less		59	34	7	74
3501 - 7000		49	42	8	80
Over 7000		28	42	30	142
Total		38	41	21	115

II. Number of Workers

A. Bogota 1978

	Space in Sq. Meters	75 or less	76-150	Over 150	Mean Area Occupied
<b>Workers</b>					
0		39	102	296	137
1		43	108	280	133
2 or more		46	109	282	165
Total		44	108	282	150

B. Cali 1978

	Space in Sq. Meters	75 or less	76-150	Over 150	Mean Area Occupied
<b>Workers</b>					
0		35	109	223	95
1		44	106	228	95
2 or more		47	108	290	136
Total		44	107	270	118

(Table V-7)

III. Household Size

A. Botota 1978

Size	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,5		37	34	29	134
Over 5		25	33	42	168
Total		31	33	35	150

B. Cali 1978

Size	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,5		43	37	20	109
Over 5		33	44	23	127
Total		38	40	21	118

IV. Age of Household Head

A. Bogota 1978

Age	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,30		52%	29%	18%	98
31,40		36%	35%	29%	131
Over 40		27%	33%	40%	163
Total		31%	33%	35%	150

B. Cali 1978

Age	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,30		41%	42%	17%	132
31,40		43%	38%	19%	104
Over 40		36%	41%	23%	121
Total		38%	40%	21%	118

(Table V-7)

V. Sex of Household Head

A. Bogota 1978

Sex	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
Male		30%	33%	37%	154
Female		36%	35%	29%	132
Total		31%	33%	35%	150

B. Cali 1978

Sex	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
Male		35%	43%	21%	124
Female		46%	33%	21%	103
Total		38%	40%	21%	118

VI. Marital Status of Household Head

A. Bogota 1978

Status	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
With Spouse		28%	34%	37%	156
Spouseless		42%	30%	28%	128
Total		31%	33%	35%	150

B. Cali 1978

Status	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
With Spouse		36%	42%	21%	121
Spouseless		42%	36%	21%	111
Total		38%	40%	21%	118

(Table V-7)

VII. Length of Residence in City by Household Head

A. Bogota 1978

Length of Residence	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
Migrated 1973-78		27%	41%	32%	148
Other		32%	33%	36%	150
Total		31%	33%	35%	150

B. Cali 1978

Length of Residence	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
Migrated 1973-78		63%	18%	19%	99
Other		37%	41%	21%	119
Total		38%	40%	21%	118

VIII. Presence of Tenants

A. Bogota 1978

Tenants	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
None		46	110	290	169
One or More		40	104	220	94
Total		44	108	282	150

B. Cali 1978

Tenants	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
None		49	108	275	130
One or More		34	107	203	66
Total		44	108	271	118

The cross-tabular evidence points to a less important, positive association between household size and area occupied by owners. Households with more than five members present consume only about 25% more space, on average, than smaller households. This result should come as no surprise since owners, as noted, consume relatively large amounts of space. In fact an interesting phenomenon is obscured by the separation of owners and renters. For there is a simultaneous interaction of growing household size and the aging of the household head, both of which encourage households to own. As households progress through their life cycle, there is both an opportunity and a demand for asset accumulation. As household heads age, they typically have larger families, generating pressures for more substantial quarters and a search for more economical ways to satisfy that demand. Once the initial investment is made, with the aid of financial institutions or via incremental construction, the out-of-pocket costs of any given amount of space consumed is less onerous for owners than for renters. This, plus the opportunity to reap the benefits of potential capital gains, means that the key link is probably between ownership, relatively large quantities of housing, and large households. Thus the relatively weak association between housing space and growing household size, given ownership, is not as important as the fact that smaller households play a relatively small role in the owner market to begin with.

As hypothesized, the increasing age of the household head is associated with larger amounts of space consumption. Part of this effect comes from the simultaneous growth in household size as the household

head ages. Among Bogota owners there is a clear progression in mean sizes from 98 square meters (30 and under) to 131 square meters (31 to 40) and 163 square meters (Over 40). In Cali, the situation is more complicated. Because of the very large mean size recorded by household heads under 30 living in units larger than 150 square meters (involving a sample of only 6 or 7 households), the overall mean size is largest for the younger households (132 square meters). Household with heads in the intermediate age continue to occupy less space (104 square meters) than their older counterparts (121 square meters).

Among the dummy variables considered, the male headed households hold an edge over the female headed households in both Bogotá (154 square meters vs 132 square meters) and Cali (124 square meters vs 103 square meters). As always, this result does not control for other variables. We know, in particular, that male headed households tend to have larger numbers present and that their incomes are higher than found among female-headed households. This could well reduce the significance of a household sex variable in any regression.

Similarly, households where a spouse is present tend to occupy more space among both Bogota and Cali owners. The differences, however, are quite small and could well be swamped by the effect of other variables as noted earlier. In Bogota, the households with a spouse present occupy 156 square meters while their spouseless counterparts use 128 square meters. In Cali only 10 square meters separate the two groups (121 vs 111 square meters).

Other dummy variables of interest include the classification of household heads as recent migrants, if they arrived within the five years prior to the survey. Here no effect can be discerned among owners

in Bogota; both groups consume a mean 148 to 149 square meters. In Cali there is a difference and it favors the longer-term residents (119 vs. 99 square meters), as hypothesized earlier.

One variable looks at the impact of using the dwelling for income-generation purposes. Since the 1978 survey does not differentiate between the existence of a business in the dwelling from the mere presence of a household member working at home, the "business in home" variable was discarded. The role of tenants within the dwelling can be examined, however. In both Bogota and Cali those who do not rent out space occupy substantially more space than those that do. In Bogota households without tenants utilize a mean 169 square meters of space, as compared with 94 square meters among their counterparts. In Cali the relevant area measures are 130 and 66 square meters, respectively.

A final variable of interest tests the possible impact of the locational disadvantage hypothesis. The latter suggests that households originating in Sectors 2 and 3 in Bogota and Sectors 3, 4, and 5 in Cali suffer handicaps unrelated to other socio-economic characteristics. Table V-8 suggests that Bogota owners originating in Sectors 2, and 3 consume space at rates below the city-wide mean of 148 square meters, joining only the small number originating in Sector 1 and those originating in Sector 6 in this respect. Among Cali owners the same result is found. Households originating in Sectors 3, 4, and 5 consume, on average, less than the citywide mean of 116 square meters. The role of other variables can only be disentangled in more complex exercises, such as the regressions that follow.

Table V-8: Household Space Consumption by  
Previous Sector of Residence of Owner Household Head

A. Bogota 1978

Sector	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1		31%	34%	35%	139
2		50%	31%	19%	99
3		33%	35%	32%	137
4		22%	44%	34%	150
5		25%	33%	42%	173
6		35%	37%	28%	128
7		22%	21%	57%	206
8		31%	28%	41%	166
Total		32%	33%	35%	148

B. Cali 1978

Sector	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1		22%	49%	30%	129
2		6%	28%	66%	249
3		41%	41%	18%	108
4		35%	58%	6%	94
5		45%	42%	13%	99
6		40%	30%	29%	125
7		38%	28%	35%	122
Total		38%	41%	27%	116

Renter Households and the Cross-Tabulations

The role of income in determining space occupied by renters appears clear-cut from the cross-tabulations, (Table V-9). Renters in Bogota earning less than the poverty-level income of 4000 pesos overwhelmingly (87%) consume less than 75 square meters, for a mean amount of 42 square meters. The proportion of other households falling into the smallest size interval falls off with rising income, especially when those earning more than the citywide median are considered. With a mean space occupancy of 109 square meters, the latter group consumes more than twice the amount reported by the poorest and twice the amount reported by the intermediate group. In Cali the pattern repeats itself in virtually all respects. Those households earning over 7000 pesos a year show the lowest concentration in the smallest size category (47% vs. over 80% for each of the two poorer groups). Similarly, the mean space consumption of the better-off households is more than twice that of the two other categories (95 square meters vs. 44 and 35 square meters).

The presence of secondary workers acts, as among owners, to boost household space consumption. In Bogota, multiple-worker households utilize an average of 91 square meters, compared with 59 square meters among their single-worker counterparts. In Cali, the same effect is present: multiple-worker households occupy an average of 92 square meters, compared to 51 square meters where only one worker is to be found.

Table V-9: Household Space Consumption According to Selected Characteristics of Renter Household

I. Income of Household

A. Bogota 1978

Income	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
4000 or less		87%	9%	4%	42
4001-8000		78%	17%	5%	54
Over 8000		49%	31%	20%	109
Total		70%	20%	10%	71

B. Cali 1978

Income	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
3500 or less		87%	12%	1%	35
3501-7000		83%	14%	4%	44
Over 7000		47%	39%	14%	95
Total		58%	25%	8%	64

II. Number of Workers

A. Bogota 1978

Workers	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
0		36	119	190	62
1		29	101	266	59
2 or More		36	107	281	91
Total		32	105	272	72

B. Cali 1978

	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
0		28	112	-	36
1		22	104	327	51
2 or More		33	114	262	92
Total		26	111	283	67

(Table V-9)

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## III. Household Size

## A. Bogota 1978

Size	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,5		74%	18%	8%	61
Over 5		53%	27%	20%	111
Total		69%	20%	11%	72

## B. Cali 1978

Size	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,5		73%	22%	6%	54
Over 5		51%	32%	17%	110
Total		68%	24%	8%	67

## IV. Age of Household Head

## A. Bogota 1978

Age	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,30		80%	14%	6%	53
31,40		66%	23%	11%	76
Over 40		60%	23%	17%	92
Total		69%	20%	11%	72

## B. Cali 1978

Age	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1,30		80%	17%	4%	48
31,40		61%	28%	11%	71
Over 40		60%	30%	11%	85
Total		68%	24%	8%	67

(Table V-9)

V. Sex of Household Head

A. Bogota 1978

Sex	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
Male		67%	20%	12%	75
Female		76%	19%	5%	61
Total		69%	20%	11%	72

B. Cali 1978

Sex	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
Male		65%	25%	9%	73
Female		75%	21%	4%	50
Total		68%	24%	8%	67

VI. Marital Status of Household Head

A. Bogota 1978

Status	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
With Spouse		66%	21%	13%	78
Spouseless		77%	18%	5%	59
Total		69%	20%	11%	72

B. Cali 1978

Status	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
With Spouse		64%	28%	9%	75
Spouseless		76%	18%	7%	53
Total		68%	24%	8%	67

(Table V-9)

VII. Length of Residence of Household Head

A. Bogota 1978

Length of Residence	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
Migrated 1973-78	68%	18%	13%	81	
Other	70%	20%	10%	70	
Total	69%	20%	11%	72	

B. Cali 1978

Length of Residence	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
Migrated 1973-78	66%	21%	12%	85	
Other	68%	27%	7%	62	
Total	68%	24%	8%	67	

VIII. Presence of Tenants

A. Bogota 1978

Tenants	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
None	32	105	273	72	
One or More	34	114	256	76	
Total	32	105	272	72	

B. Cali 1978

	Space in Square Meters	75 or less	76-150	Over 150	Mean Area Occupied
None	25	111	284	67	
One or More	44	105	238	68	
Total	26	111	283	67	

Household size exerts a strong positive influence on space consumed, if the cross-tabulations are used as a guide. In Bogota renter households with 5 or fewer members consume only 61 square meters, on average, compared to 111 square meters for other, larger households. The Cali results (54 square meters vs. 110 square meters) are almost identical. In both cases, the smaller household prove to be concentrated in units of less than 75 square meters, where 73% to 74% of their numbers are found. By way of contrast, only 52%-53% of the larger households are lodged in the smallest size units.

As already noted, separating owners and renters in this analysis masks the fact that the renter market is typically geared toward smaller households. Thus, in Bogota, owner households average 5.5 persons, while among renters the mean is only 4.3 persons; similar differences prevail in Cali (5.6 vs. 4.0 persons, respectively).

Age reappears as an important variable among renters. These renter households are, on average, headed by young individuals. Thus only 32% of Bogota owners are 40 years of age or younger, while fully 70% of the renters are that young. For Cali, the proportions are 32%

and 63%. Acting as a proxy for such factors as unmeasured assets and family size, increasing age is associated with increasing space consumption. Thus, households headed by individuals 30 years of age or younger consume only about 60% of the space used by households whose head is over 40, with the intermediate age household heads falling roughly in between in space utilized.

As among owners, the sex of the household head has some impact on household space consumption, especially among Cali renters. While male-headed units occupy dwellings that are slightly above the city mean (75 square meters in Bogota and 73 square meters in Cali), their female counterparts live in dwellings that are 14 (Bogota) to 23 (Cali) square meters smaller. Much the same effect is found when households are separated according to the presence or absence of a spouse. Those households with spouses present live in units slightly larger than the city mean (78 square meters in Bogota; 75 square meters in Cali). Those households without a spouse live in units roughly 20 square meters smaller in size than their counterparts.

Some effect is also noted when recent households headed by migrant are compared with longer-term residents. The effect, however, is counterintuitive in both cases, for the recent migrant households are associated with mean size dwellings which are larger than those of other households. While the difference in Bogota is only 11 square meters, on average (81 vs. 70 square meters), in Cali it equals 23 square meters (85 vs. 62 square meters). In both cases the units headed by non-recent migrants are close to the respective citywide mean size. The difference

lies principally in the higher proportion of recent migrants found in the largest size dwellings (150 square meters) combined with larger mean size units within that interval. If the small percentage of households found in the largest category are excluded, the differences between the two groups vanishes in both cities.

In contrast with the behavior found among owners, renters who sub-let space do not appear to consume less space, on average, than their counterparts. This is true for both Cali and Bogota. As noted, this type of business use of the dwelling is relatively rare among renter households.

The locational disadvantage hypothesis could be used to predict smaller average size units in Sectors 2 and 3 in Bogota and 3, 4, and 5 in Cali. For Bogota the results (Table V-10) are identical to those found among owners namely, that households whose previous sector of residence was Sectors 2 and 3, occupy premises that fall below the city mean in average size; they are joined by those originating in Sector 1, and 6. The pattern is repeated in Cali for Sectors 3, 4, and 5. Interestingly enough, renters originating in the privileged Sector 7 also have below mean average size units.

Table V-10: Household Space Consumption by  
Previous Sector of Residence of Renter Household Head

A. Bogota 1978

Sector	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1		82%	15%	3%	54
2		83%	12%	5%	52
3		68%	25%	7%	62
4		56%	28%	16%	84
5		68%	19%	13%	74
6		73%	19%	8%	63
7		60%	18%	22%	103
8		54%	17%	29%	127
Total		70%	19%	11%	71

B. Cali 1978

Sector	Space in Square Meters	75 or less	76- 150	Over 150	Mean Area Occupied
1		42%	53%	53%	75
2		19%	20%	61%	313
3		76%	21%	4%	48
4		74%	20%	6%	49
5		70%	24%	5%	60
6		65%	20%	15%	81
7		62%	38%	0%	64
Total		68%	24%	7%	66

### A Simple Model of Space Consumption

The results from the cross-tabulations can be compared with linear regression estimations for owners, for renters, and for all households.

Among owners (Table V-11) in both cities there is agreement in most cases on the signs of the coefficients; differences appear only for two statistically insignificant coefficients (very recent migrant household heads and couples). There is also near total agreement on the significance of the coefficients; only in one case, involving the measure of a disadvantaged sector of origin, is the Bogota result significant and the Cali value insignificant. The related values of elasticities or slope shifts (for dummy variables) are also very close. Among those variables with significant coefficients, the income elasticity is 0.5 in Bogota and Cali; the family size elasticity is 0.2 in both cities; and the elasticity associated with the number of households workers in the household is -0.2 in each city.

In both cities the presence of tenants in household is an apparent sign of financial stringency, leading in each case to a third less space consumption per average household, all other things being equal. Reliance on auto construction has a similar effect, cutting consumption, on average, by 20% in each city. Finally the origin sector effect, significant in Bogota, is associated, in that city, with a relatively small, 10% decline in average space consumption.

How do these results compare with the cross-tabulations? The cross-tabulations found positive associations of space consumption with household head income, household head "age", and family size; all these are confirmed in the multivariate analyses. Similarly, the depressing

Table V-11: Housing Demand in Square Meters -  
Bogota Owner 1978

	Estimated Coefficients (t-ratio)	Elasticities	Sample Mean
Constant	-8.17 (0.22)		
Income	5.38 (14.07)	0.465	15.55
Income Squared	-0.03 (8.46)		
Age	2.13 (1.38)	0.466	47.14
Age Squared	-0.007 (0.45)		
Family Size	16.20 (4.22)	0.235	5.57
Family Size Squared	-0.89 (3.43)		
Sex (F-1)	4.48 (0.40)		0.200
Number of Household Workers	-12.20 (4.02)	-0.150	1.823
Presence of Tenants	-50.51 (7.67)		0.268
Auto Construction (Y=1)	-30.49 (4.80)		0.318
Household Head Migrant 1/	5.39 (0.26)		0.019
Household Head Migrant 5 2/	-15.87 (1.16)		0.045
Couples (Y=1)	-2.53 (0.22)		0.797
Origin Sector (2,3=1)	-15.50 (2.53)		0.336
Adj R <sup>2</sup>	0.3145		Occup. Area = 148.75
# of Observ.	1411		

1/ Recent Migrant 1 represents a household head who arrived within the previous two years.

2/ Recent Migrant 5 represents a household head who arrived between 2 and 5 years ago.

(Table V-11)

Housing Demand in Square Meters - Cali Owner 1978

	Estimated Coefficients (t ratio)	Elasticities	Mean Values
Constant	6.659 (0.15)		
Income	5.474 (7.45)	0.520	12.31
Income Squared	-0.027 (2.85)		
Age	0.428 (0.24)	0.300	47.82
Age Squared	-0.003 (0.19)		
Family Size	13.953 (2.59)	0.240	5.52
Family Size Squared	-0.816 (2.06)		
Sex (F=1)	17.014 (1.33)		0.288
Number of Household Workers	-9.967 (2.67)	0.165	1.88
Presence of Tenants (Y=1)	-35.888 (3.63)		0.173
Auto Construction (Y=1)	-23.334 (2.92)		0.341
Household Head Recent Migrant 5 2/	-19.197 (0.96)		0.032
Couples (Y=1)	9.826 (0.80)		0.684
Origin Sector (3,4,5=1)	-8.877 (1.16)		0.640

Adj R <sup>2</sup>	0.3540	Occup. Area = 113.88
# of Observ.	469	

- 1/ Recent Migrant 1 represents a household head who arrived within the previous two years.
- 2/ Recent Migrant 5 represents a household head who arrived between 2 and 5 years before the survey.
- 3/ t-statistic

effects of having tenants, resorting to autoconstruction and originating in a disadvantaged sector are also confirmed. Disagreements on sign exist in three cases: household head sex, number of household workers, and the marital status of the household head. Only in the case of the number of household workers do the cross-tabulations point to a positive coefficients to a statistically significant negative association; the reasons for this have been explored in previous sections, where the self-same problem emerged. Recent migrancy status has no discernible impact on space consumption in the Bogota cross-tabulations and this is confirmed by the lack of statistically significant coefficients for the migrancy variables. The Cali cross-tabular evidence suggests a depressing impact of recent migration; the regression coefficients are insignificant though negative in sign. Overall, then, the cross-tabulations work well for all variables with significant coefficients except the one referring to the number of household workers. Variables which rarely are significant in the multivariate analysis, throughout the various sections of this report, such as household head sex and marital status, are among the few that the cross-tabulations fail to classify as unimportant.

Among renters (Table V-12) in both cities, there is agreement on the signs of the coefficients in all but three cases: household head sex, the presence of tenants and the marital status variable. Only in the case of household head sex are the coefficients also significant: in Bogota the coefficient has a positive sign, in Cali a negative one. There is agreement on all untransformed variables; the square of household income and household head age is significant only in Bogota; the square

Table V-12

Housing Demand in Square Meters - Bogota Renter 1978

	Estimated Coefficients (t-ratio)	Elasticities	Sample Mean
Constant	-62.605 (3.39)		
Income	3.95 (11.00)	0.538	10.20
Income Squared	-0.01 (2.58)		
Age	2.70 (3.01)	0.636	36.63
Age Squared	-0.02 (2.44)		
Family Size	9.52 (3.14)	0.404	4.30
Family Size Squared	-0.33 (1.29)		
Sex (F=1)	11.59 (1.83)		0.216
Number of Household Workers	-3.03 (1.27)	-0.066	1.557
Presence of Tenants (Y=1)	7.26 (0.82)		0.049
Household Head Recent Migrant 1 1/	2.39 (0.28)		0.057
Household Head Recent Migrant 5 2/	10.96 (1.82)		0.119
Couples (Y=1)	8.37 (1.38)		0.730
Origin Sector (2,3=1)	-12.81 (3.20)		0.419
Adj R <sup>2</sup>	0.3047		Occup. Area 71.07
# of Observ.	1447		

1/ Recent Migrant 1 represents a household head who arrived within the previous two years.

2/ Recent Migrant 5 represents a household head who arrived between 2 and 5 years before the survey.

Housing Demand in Square Meters - Cali Renter 1978

	Estimated Coefficients (t-ratio)	Elasticities	Sample Mean
Constant	-68.112 (2.17)		
Income	3.219 (4.27)	0.473	10.05
Income Squared	-0.004 (0.47)		
Age	2.302 (1.66)	0.533	37.96
Age Squared	-0.018 (1.16)		
Family Size	23.783 (4.11)	0.673	4.19
Family Size Squared	-1.561 (2.97)		
Sex (F=1)	-13.472 (1.77)		0.219
Number of Household Workers	4.568 (1.04)	0.108	1.571
Presence of Tenants (Y=1)	-4.577 (0.34)		0.070
Household Head Recent Migrant 1 <u>1/</u>	13.396 (0.91)		0.070
Household Head Recent Migrant 5 <u>2/</u>	20.344 (2.02)		0.137
Couples (Y=1)	-16.462 (1.49)		0.683
Origin Sector (3,4,5=1)	-22.360 (2.70)		0.718
Adj R <sup>2</sup>	0.3628		Occup. Area = 66.66
# of Observ	401		

1/ Recent Migrant 1 represents a household head who arrived within the previous two years.

2/ Recent Migrant 5 represents a household head who arrived between 2 and 5 years before the survey.

3/ t-statistic

of family size is significant only in Cali. The associated values of elasticities and slope shifts are quite similar, though less so in the latter case. The elasticities for income are both 0.5; for age they are 0.6 in Bogota and 0.5 in Cali; and for family size they are 0.4 in Bogota and 0.7 in Cali. The income and age elasticities (disregarding significance) are quite similar for owners and renters in both cities. The same is not the case for the family size variable. The renter elasticities in this case are two to three times higher than those found among Bogota and Cali owners. As noted previously, owners tend to have larger families, on average, than do renters; this factor may explain the heightened space use effect of adding an individual to the renter household.

The three significant dummy variables are household head sex, the migrancy status of the household head, and the sector of prior residence of the household head. Only in the case of the latter variable is there any correspondence to the owner household effects. The two data sets produce very different results for the impact of having a female-headed household: at the mean it adds 17% to household space in Bogota and subtracts 25% in Cali. There is no particular reason to expect these results. Household heads who migrated to the city between 2 and 5 years prior to the survey consumed, on average 16% more space in Bogota and 30% more space in Cali than otherwise similar households. Once again, the results are not intuitively obvious ones. It should be noted, however, that the cross-tabulations give clear forewarning of this association. Finally, a significant sector of origin-effect appears to exist among renters, especially in Cali: on average, Bogota renters

consume 18% less space and Cali renters consume 30% less space if the prior sector of residence was listed in Section I as "disadvantaged". This impact far exceeds any discerned among owner households, where the penalty for a disadvantaged sector origin was closer to 10% in Bogota and not detectable in Cali.

If one looks at the cross-tabular results for renters in both cities, one finds that the positive association of space consumption with household income, household head age, and family size are all confirmed by the multivariate analyses. Though the cross-tabulations suggest a positive link between the space consumption and the number of household workers, the regression coefficients are insignificant and carry negative signs.

The cross-tabulations correctly predict the absence of any relationship between space consumption and the presence of tenants; the absence of any relationship is probably related to the rarity of sub-leasing in both cities. Similarly correct is the predicted positive association between space consumption and the recent migrancy (2-5 years) of the household head, as already noted. Finally, the cross-tabulations accurately predict the depressing effect of a "disadvantaged" sector of previous residence on space consumption.

As has been the case in previous sections, the positive link of space utilization and the presence of a spouse proves spurious in the multivariate analyses. In addition the uniformly negative impact of a female head of household on space use is borne out only in Cali; in Bogota the relevant multivariate coefficient is positive and significant.

Exceptions aside, the cross-tabulations once again prove to be useful guides in data analysis, rarely failing to be verified in more sophisticated tests which control for the impact of other variables.

Some observers have suggested that the estimation be carried out with pooled data, using tenure choice as one of the explanatory variables. Table V-13 presents results for Bogota and Cali. The dummy variable representing ownership has a very strong effect, adding 49 square meters, at the mean, to space occupied; this is equivalent to a slope shift of 45 percent. All explanatory variables are significant except age, household sex, the recent migrancy status of the household head, and the presence of a spouse. The self-same variables are the ones with insignificant coefficients in the owner equations; the presence of a spouse variable also has an insignificant coefficient in the renter case.

All elasticities in the pooled case are almost identical to those found in the individual equations, except for the fact that the renter family size coefficients still have "outlier" elasticities.

Among the dummy variables, a "tenants" effect and a "disadvantaged sector of previous residence" effect continue to be significant. The first is still large and not dissimilar in magnitude (though opposite in sign) from the "owner" effect. The disadvantaged sector effect is, in the pooled version, a relatively small one, amounting to a slope shift of 13 percent.

Finally the amount of explained variance remains, at .37, close to that found in each previous equation. The pooled analysis thus does not produce any marked surprises and does not overturn the thrust of the earlier analysis.

Table V-13

Housing Demand in Square Meters Bogota 78

- All Households -

	Estimated Coefficients (t-ratio)	Elasticities at the Mean	Sample Mean
Constant	-47.06 (2.67)		
Income	5.32 (20.86)	0.534	12.84
Income Squared	-0.03 (10.85)		
Age	1.34 (1.63)	0.384	41.82
Age Squared	-0.004 (0.41)		
Family Size	13.97 (5.81)	0.296	4.93
Family Size Squared	-0.75 (4.26)		
Sex (F=1)	9.93 (1.63)		0.208
Number of Household Workers	-8.83 (4.50)	-0.136	1.688
Presence of Tenants (Y=1)	-41.21 (8.25)		0.157
Owner (Y=1)	49.43 (12.20)		0.494
Household Head Recent Migrant 1 <u>1/</u>	5.45 (0.60)		0.038
Household Head Recent Migrant 5 <u>2/</u>	5.92 (0.93)		0.082
Couples (Y=1)	3.80 (0.63)		0.763
Origin Sector (2,3,=1)	-14.20 (3.89)		0.378
Adj R <sup>2</sup>	0.3732		Occup. Area = 109.42
# of Observ	2858		

1/ Recent Migrant 1 represents a household head who arrived within the previous two years.

2/ Recent Migrant 5 represents a household head who arrived between 2 and 5 years ago.

Summary

Owners occupy more space than renters, whether viewed as a whole or within categories like "low income". Low-income households are smaller in size than the average for each over-all category, and their space utilization is also smaller. Among owners, space consumption is enhanced by household income and househod size. The need to rely on self-help housing construction methods, to depend on secondary workers, and to rent out to tenants, tends to depress consumption. There is limited evidence of an independent depressed sector of origin effect. The magnitudes of these effects are similar in Bogota and in Cali. Among renters, space consumption is enhanced by the self-same variables cited in the owners case plus a history of recent migration to the city and the age of the household head. Household head sex does have a significant impact on space consumption among renters, though the effects differ in Bogota and Cali. Among the continuous variables there is a broad similarity in elasticities when compared to the set of owner households; one clear exception is the far larger family size effect found among renter households. Origination in a disadvantaged sector depresses space consumption among renters, and does so at a rate far higher than that experienced, on average, by owner households. Pooling the data confirms the very strong role played by ownership in boosting space utilization, while generally confirming the significance and magnitude of variables utilized in the separate owner and renter equations.