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Urban Development and Land and Housing Market Dynamics in Bogotá, Colombia

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INTRODUCTION

Issues related to housing and land markets are a constant theme in the national life of Colombia. As Robledo (1985) declares:

> The rapid urbanization of Colombia during the second half of the 20th century and the notorious housing shortage affecting the majority of the population; the invasion of idle lands and the confrontations with civil authorities; the sordid living conditions of the residents of inquilinatos [large old residences converted into rooming houses] and the periodic eviction of families that cannot pay the rent; the belts of misery that surround the cities and the millions of citizens who do not have access to public services; the growth of "pirate" subdivisions and the chronic underfinancing of the ICT [the government agency in charge of low-income housing]; the proliferation of supposedly "non-profit" entities involved in self-help housing and the political payoffs from aiding low-income neighborhoods; the links between the UPAC [indexed savings certificates] system, inflation, and the high interest rates which plague the construction industry; and the transformation of construction into a development "motor" .... all these issues keep the problem of housing in the public eye. (p. 1, present authors' translation)

The drama of the search for shelter is carried out thousands of times daily in the Colombian capital of Bogotá. Most of the poor will end their search by reluctantly staying a little longer with other family members, moving into a deteriorated rooming house, or opting for some type of "self-help" housing solution. At the other extreme, the affluent will probably succumb to the social pressure (exploited brilliantly by newspaper advertisements) to live in the upscale housing developments in the northern part of the city. While the dwellings of the more well-off will generally not be lavish by the standards of the richest countries, they may include amenities such as 24-hour security and satellite television.

As they make their choice of dwelling, all residents of Bogotá, but especially those with sufficient resources to enter into the formal housing market, will be participating in a massive restructuring of space. Advertisements for Metrópolis, a large residential and commercial development in northwest Bogotá, refer to the project as "another city within the city." The phrase is an allusion to the National Planning Department's plans for "ciudades dentro de la ciudad," satellite centers of employment and residence within the large cities of Colombia. The program as originally conceived was never developed on a national scale. In Bogotá, however, public and quasi-public agencies, as well as the private sector, have been both creating and responding to forces which favor the emergence of a multinucleated spatial structure.

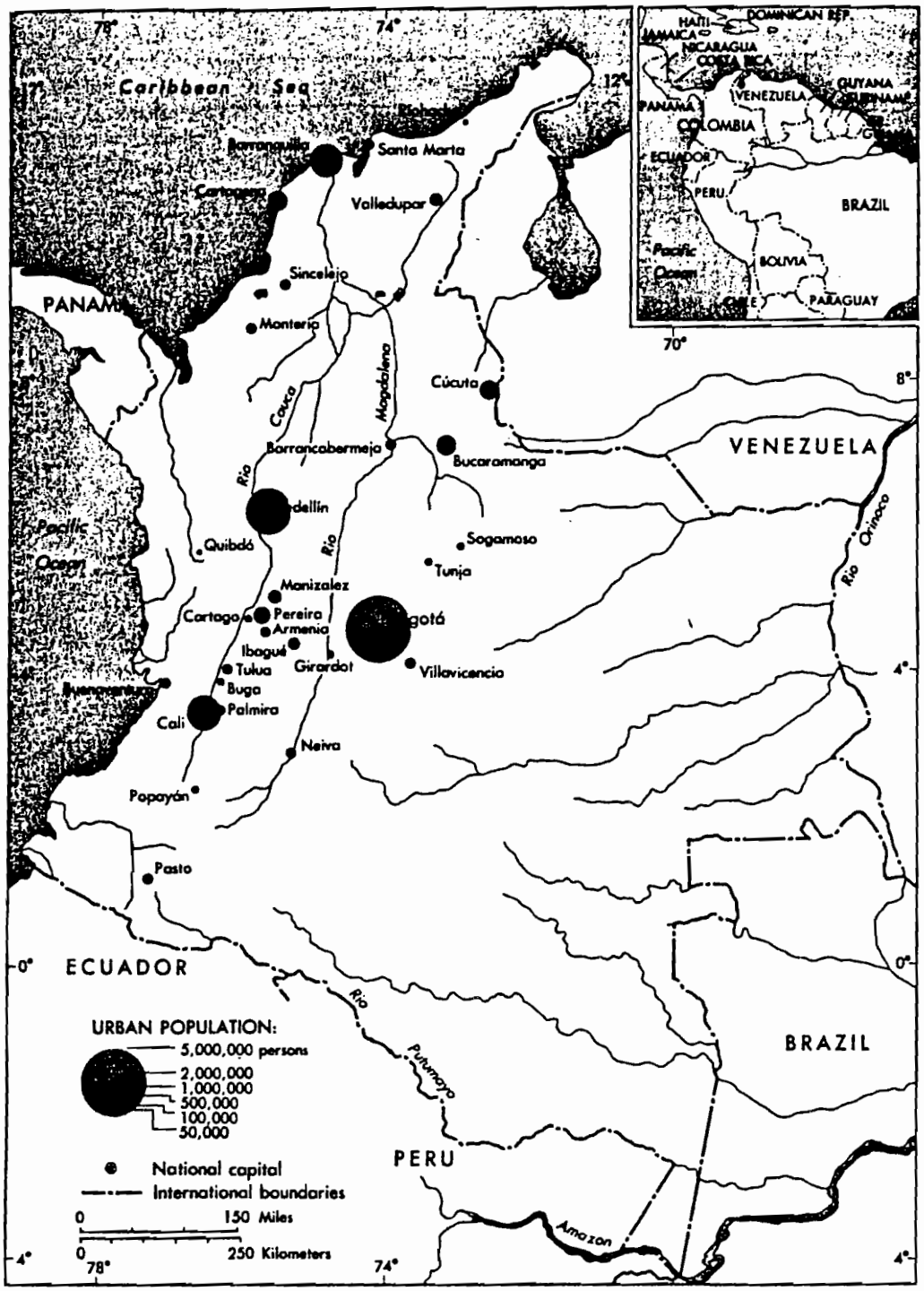
Coupled with the change in Bogotá's spatial configuration is an equally significant shift in the intensity of land use:

> Within a few years, only a small number of one- and two-story houses will remain in Bogotá and other cities [of Colombia], survivors of the levelling activity of bulldozers... Today, in obedience to a misconceived policy of densification and rising land prices, countless numbers of single-family dwellings have been indiscriminately erased from the map. Most of the houses have been destroyed, and in their place dozens of apartment buildings have been constructed. (Ramírez, 1986, present authors' translation)

The author of the above quote exaggerates somewhat; the single-family house is not about to disappear from Bogotá. However, its importance as a choice of shelter for middle-income residents is clearly declining. Some existing houses are being demolished, others subdivided, but above all, the number of new houses constructed by the formal sector is dwarfed by the number of apartments.

Land policies and problems in increasingly urbanized developing countries can no longer be thought of solely or even mostly in terms of rural "land reform." Likewise, while the desperate poverty of much of the rural Third World continues to demand a solution, the sheer magnitude of urban growth and the resulting housing crises also cries out for attention. In Colombia, where, in 1980, 70 percent of the population was classified as urban, four cities had metropolitan-area populations greater than one million (Map 1), and 21 had populations of between 100,000 and one million, the "urban problem" has a place on the agenda of all political parties which is at least as prominent as that

Map 1. Cities of Colombia.



Source: Taken from Mohan, 1986.

of the "rural problem" (Pradilla Cobos, 1974). For some sectors of the Colombian urban population, land itself is not an object of direct concern. However, whether households rent, buy a lot in a "pirate" subdivision, or purchase a house or apartment offered through the formal sector, the choices they can make are shaped by the workings of the land market. The land market is by no means the only factor influencing housing supply, however. Government policies, the structure of the building industry, and above all, the characteristics of credit markets, are all crucial determinants of how people live in Bogotá and other cities of Colombia.

This paper is a preliminary effort to identify the characteristics of land and housing markets in Bogotá, as well as key policy issues facing the city as it confronts the shelter crisis. The work is part of a larger study, a comparative analysis of land and housing markets in cities of the developing world. The Bogotá research is also being conducted for a doctoral dissertation which will focus especially on the links between the dynamics of land markets, forms of production of housing, and spatial structure. The terms "megacity" and "supercity" have been used to describe the gigantic urban agglomerations of the Third World. A recent study (Kasarda and Dogan, eds., 1987) contrasts the continued urban growth of the "two-thirds world" with the apparently relentless decentralization and deconcentration of population and economic activity in the rich countries. The popular image of the developing world's megacities is that they are hopelessly impoverished, anarchic, and congested, with massive housing deficiencies, infrastructure strained beyond capacity, and travel times stretched to unbearable limits. While this assessment contains a great deal of truth, there is also cause for optimism regarding the Third World's supercities. While it is true that many migrants to urban areas of the developing countries are being "pushed" by rural poverty and violence, they are also being "pulled" by the very real prospect of a better life in the city. For all their poverty, Third World cities represent impressive agglomerations of physical and human capital. Regardless of who one believes should be producing housing, the informal sector has proved remarkably dynamic in cases in which the state and formal-sector builders do not reach low-income households. This is not to deny the existence of a serious shelter crisis in the developing world, but is rather a tribute to human ingenuity in the face of economic hardship.

Pessimism regarding the megacity is also exacerbated by the persistent use of an outdated monocentric paradigm. Cities within cities are forming,

even in the absence of deliberate state policies to promote this outcome. In an optimistic scenario, the megacity will be able to take advantage of economies of scale, at the same time that having dispersed residential and employment centers will reduce congestion and travel times.

It has long been a matter of debate whether developing countries have their own unique set of dynamics, or whether, as in Marx's oft-misinterpreted quotation, the experiences of poor nations only reflect those of their more affluent counterparts in an earlier stage of development. It is obvious that cities of developing countries will never replicate exactly the patterns and processes of older urban areas in the developed world, which had their peak growth under very different technological conditions, and in most cases evolved much more gradually than the exploding metropolises of the Third World. Nevertheless, as urban areas in rich countries continue a transition from suburbanization to polynucleation, it is appropriate to ask whether cities in developing countries will follow the same path. Our research will help us to understand both the uniqueness and the universality of the developing megacity's experiences.

THE NATIONAL CONTEXT

Colombian Demographic and Economic Trends

Table 1 shows the trends in Colombia's population from the late eighteenth century until the 1985 census. With a population now exceeding 30 million, Colombia has surpassed Argentina to become the third-largest Latin American country, after Brazil and Mexico. The land area of Colombia is approximately 1.14 million square kilometers (440,000 square miles), roughly equivalent to the areas of Texas and California combined. With a per capita GNP estimated at $1,230 U.S. in 1986 (International Bank..., 1988), Colombia has been classified by the World Bank as belonging to the upper ranges of the "lower-middle-income developing" countries. Four South American countries had a per capita GNP lower than Colombia in 1986: Ecuador, Peru, Bolivia, and Paraguay. The GNP per person in Brazil was $1,810 U.S., almost 50 percent higher than Colombia. While Colombia has not experienced the periods of explosive economic growth that have occurred in countries such as Brazil and Venezuela, it has also been

Table 1

Population of Colombia, 1778-1985

Year	Total Population	Annual Growth Rate (percent)
1778	786,983	
		.8
1825	1,129,174	
		2.4
1851	2,105,622	
		2.2
1887	3,666,000	
		.7
1905	4,122,000	
		2.3
1918	5,553,852	
		2.1
1938	8,407,956	
		2.5
1951	11,548,172	
		3.2
1964	17,484,508	
		1.9
1973	20,785,235	
		2.5
1985	27,867,326	

SOURCES: Ocampo, ed., 1987; Colombia, DANE, 1986.

able to avoid the wrenching recessions that have typically followed its neighbors' "boom" periods.

The difficult physical terrain of Colombia has encouraged regional separation. While under some scenarios this could have led to one region completely dominating the national economy, in the case of Colombia the emergence of dynamic economic activity in each of four regions created an urban hierarchy unique in Spanish-speaking Latin America. While policy-makers in many Latin American countries would like to reduce their nations' urban primacy, the largest city is still far bigger than the second-place urban area. In Mexico, Peru, Chile, Argentina, Uruguay, Paraguay, and all of the Central American countries except Honduras, the largest metropolitan area has a population at least eight times that of the second-place city. In Colombia, on the other hand, the largest city (Bogotá) is only about two-and-one-half times the size of the next two cities in the hierarchy, Medellín and Cali. There are three cities in Colombia with a population in the range of one million or more, and the fourth-ranking city, Barranquilla, has just under one million inhabitants.

A comparison of intercensal growth rates (Table 2) reveals that from 1938 to 1951, Cali was the fastest-growing of the four largest Colombian cities, followed by Medellín. Cali's average annual growth rate during this period was an astounding 8.68 percent. From 1951 to 1973, Bogotá took the lead, with growth rates slightly above 6 percent. Cali and Medellín followed closely behind. Finally, from 1973 to 1985, annual population growth rates in all the cities declined dramatically. Cali was again the fastest-growing of the four cities, with Bogotá not far behind, and Medellín and Barranquilla both trailing. The 20 largest cities in Colombia had a combined population of almost 12 million in 1985 (Table 3), of which Bogotá, the largest city, represented only 35 percent. Bogotá had 21 percent of Colombia's total urban population in 1985. While this was a significant jump from the figure of 13 percent in 1938, it was still a low figure compared with the capitals of other Latin American countries. One out of every seven Colombians lived in Bogotá in 1985, compared with one out of 25 in 1938. In contrast, currently one out of three persons in Argentina lives in the greater Buenos Aires metropolitan area, and one out of five inhabitants of Mexico lives in or around the capital (including Nezahualcóyotl) (Almanaque Mundial, 1986).

Table 2

Population of the Four Largest Cities in Colombia, 1938-1985

Year	Bogotá	Medellín	Cali	Barranquilla
1938	358,206	170,110	103,016	154,042
	(6.0)	(6.5)	(8.7)	(5.2)
1951	765,581	383,500	304,268	299,387
	(6.4)	(5.7)	(6.0)	(4.1)
1964	1,723,707	785,454	648,302	506,676
	(6.2)	(4.5)	(4.8)	(3.7)
1973	2,961,913	1,163,868	991,549	703,488
	(2.9)	(2.4)	(3.0)	(2.4)
1985	4,176,929	1,550,896	1,418,747	936,468

NOTE: Numbers in parenthesis refer to inter-censal annual population growth rates in percent.

SOURCE: Bogotá, Alcaldía Mayor, 1987 (from census data).

Table 3

Population of the 20 Largest Cities in Colombia, 1985

City	Population
Bogotá	3,982,941
Medellín	1,468,089
Cali	1,350,565
Barranquilla	899,781
Cartagena	531,426
Cucuta	379,478
Bucaramanga	352,326
Manizales	299,352
Ibague	292,965
Pereira	287,999
Pasto	244,700
Monteria	224,147
Santa Marta	218,205
Palmira	214,395
Bello	212,861
Neiva	194,556
Buenaventura	193,185
Valledupar	192,049
Armenia	187,130
Villavicencio	179,685
TOTAL	11,904,935

NOTE: Population figures are unadjusted results from the 1985 census.

SOURCE: Colombia, Departamento Administrativo Nacional de Estadística, 1986.

Industrialization and Urbanization in Colombia

Industrialization and urbanization have been concurrent processes in Colombia. Growth in the country's largest cities has not been a function of international trade. Colombia's most important port, Buenaventura, has a population of under 200,000, and Barranquilla, a Caribbean port, has grown more slowly in the last 50 years than the country's other major metropolitan areas. Each of the four leading urban areas (Bogotá, Medellín, Cali, and Barranquilla) serves as a "regional capital," with the employment in government and financial services that this implies. These cities are also distribution centers for agricultural products. However, none of these functions can explain urban agglomerations of such magnitude (one million inhabitants and more). Industrial employment is only a small percentage of total urban employment, but manufacturing is an important "glue" which holds together the economy of cities through forward and backward linkages.

When Colombia achieved independence from Spain in the early nineteenth century, the conditions for large-scale industrialization or even the spread of capitalist relations of production were not favorable. The faint beginnings of modern manufacturing could be found in the artisans who produced clothing and leather goods (Jaramillo and Cuervo, 1987). Industrialization in a more recognizable form came to Colombia in the 1830s, with the establishment of factories producing china and ceramics, glass, paper, and textiles. All of these firms were in Bogotá, and they were not entirely successful (Ospina Vásquez, 1955). The industrialization of Colombia continued in fits and starts, but only gathered momentum during the final decades of the nineteenth century. The factors which permitted manufacturing to finally take root included the capital accumulation from the emergence of a new dynamic export product (coffee), the continued world demand for gold, improvements in transportation infrastructure (roads and the railroad), and increased protectionism (Jaramillo and Cuervo, 1987). This process of development was self-reinforcing: expanding trade produced capital for further investment and stimulated domestic demand through increased incomes and the growth in urban employment.

The products which began to be manufactured in Colombia during the late 19th and early 20th centuries tended to be items which simultaneously faced a growing internal demand and which, for reasons of input or transport costs, could be produced advantageously within the country. Examples include bever-

ages, chocolate and tobacco products, and textiles. While at this stage of development there was some regional specialization, transportation difficulties meant that individual firms continued to have a mostly local orientation (Jaramillo and Cuervo, 1987).

The acceleration of Colombian industrialization during the 1930s occurred through a process of import substitution. The Great Depression disrupted existing trade networks, creating opportunities for local entrepreneurs to serve an expanding domestic market. This de facto protectionism was prolonged by the Second World War.

The present spatial configuration of industry in Colombia is not greatly different from the patterns that were emerging in the 1930s and even earlier. What has changed over time is the relative importance of each of the four leading industrial areas, Bogotá, Medellín, Cali, and Barranquilla. Since 1945, Barranquilla has slipped in relative terms. Medellín has maintained its first-place position in terms of the number of industrial employees per 1000 inhabitants, but Bogotá has taken the lead in the absolute level of employment (Tables 4 and 5). In 1980, the four largest urban areas had around one-third of Colombia's total population, and had over 70 percent of the total industrial employment.

Three of the leading urban agglomerations have industries for which the share of total national employment in that sector is considerably ahead of the other cities (Table 6). For example, Medellín has just under half of Colombia's employment in textiles, almost twice the share of the capital. Bogotá, in turn, has over half of the employment in transportation equipment and materials, and this is more than twice the share of Medellín. Cali maintains a relatively strong position in paper and paper products, while Barranquilla is not dominant in any industry. Yet, although there is some regional specialization, when we look at which industries have the highest absolute levels of employment, we find a remarkable similarity across cities. From Table 7, the clothing and foodstuffs sectors are among the top three industrial producers in each of Colombia's four largest urban areas. The metallic products sector figures among the top four employers except in Cali. The spatial distribution of several leading industries would appear to have more to do with access to markets than with proximity to raw materials. This is the case of processed foods, beverages, clothing, and shoes.

Table 4

Industrial Employment in Colombia, 1945-1980

	1945	1958	1966	1974	1980
Bogotá	22,598	60,146	76,421	126,659	148,104
Medellín	30,412	51,963	70,427	109,408	122,940
Cali	10,041	26,176	338,736	55,651	61,140
Barranquilla	14,339	23,163	26,944	35,244	40,029
TOTAL COLOMBIA	134,883	235,980	290,197	448,477	527,659

SOURCE: Jaramillo and Cuervo, 1987.

Table 5

Industrial Employment per 1,000 Inhabitants, Four Largest Cities in Colombia, 1945-1980

	1945	1958	1966	1974	1980
Bogotá	47.98	53.99	38.52	42.44	39.73
Medellín	117.62	83.37	68.94	72.83	66.38
Cali	64.71	63.99	55.22	53.82	49.47
Barranquilla	66.17	57.11	46.74	44.26	41.18

SOURCE: Jaramillo and Cuervo, 1987.

Table 6

Characteristics of Industrial Employment
in the Four Largest Urban Areas of Colombia, 1982

Industry Classification	Employment by Area				
	Bogotá	Medellín	Cali	Barranquilla	Colombia
Foodstuffs(not incl beverages)	14,282	8,288	5,535	3,981	66,217
Animal feed	2,127	1,633	839	1,148	9,993
Beverages	6,841	3,350	2,123	2,255	27,164
Tobacco products	869	961	285	209	3,281
Textiles	15,122	27,061	3,931	1,793	57,349
Clothing (not incl. shoes)	14,008	14,497	6,406	5,540	49,922
Leather & leather products (not including shoes)	2,662	1,782	1,077	588	7,116
Shoes, except molded rubber & plastic	3,215	2,565	1,517	299	10,879
Wood & cork, except furniture	1,344	872	585	1,875	6,314
Furniture, except principally metallic	3,145	1,142	212	484	7,302
Paper & paper products	2,288	2,308	3,946	921	11,228
Publishing	9,686	2,460	4,016	846	20,062
Industrial chemicals	1,260	4,169	1,666	2,092	16,650
Other chemicals	11,620	4,184	5,666	1,170	24,801
Petroleum refineries	-	-	-	-	5,056
Petroleum and coal derivatives	365	71	-	75	657
Rubber products	4,280	449	1,889	196	8,682
Plastic products	7,696	3,740	1,682	1,892	16,542
Clay, china, and porcelain products	215	3,018	404	-	4,996
Glass & glass products	2,076	741	537	387	6,013
Other mineral products, non-metallic	4,522	4,445	1,806	1,452	21,437
Basic iron & steel industry	1,315	1,940	1,173	305	14,067
Basic industry, non-ferrous metals	246	319	840	637	2,176
Metallic products, except machinery & equipment	11,623	6,829	2,983	2,881	29,572
Machinery, except electrical	6,105	3,204	2,064	706	435
Electrical machinery, devices, & supplies	8,548	2,525	3,334	723	14,276
Transportation equipment & materials	9,576	3,693	1,522	2,617	16,955
Scientific, measurement, photo-graphic, & optical equipment	1,054	636	427	67	20,828
Other manufacturing industry	2,555	1,848	1,325	798	2,470
Total mfg. employment	148,755	108,730	57,790	35,937	489,023

SOURCE: Colombia, DANE, 1982.

Table 7

Industries with the Highest Levels of Employment
in the Four Largest Urban Areas of Colombia, 1982

Employment by Area				
Bogotá	Medellín	Cali	Barranquilla	Colombia
Textiles	Textiles	Clothing	Clothing	Foodstuffs
Foodstuffs	Clothing	Other Chemicals	Foodstuffs	Textiles
Clothing	Foodstuffs	Foodstuffs	Metallic	Clothing
Metallic products	Metallic products	Publishing	Transportation equipment	Metallic products

SOURCE: Colombia, DANE, 1982.

THE DEVELOPMENT OF BOGOTA

The Spanish founded the town of Santa Fe de Bogotá in August 1538, and in 1550 made in the capital of the "Nuevo Reino de Granada" (New Kingdom of Granada), the territory now occupied by Colombia. Bogotá has been a political capital for almost all of its 450 years. However, due to its geographic isolation and the dominance of agriculture in the Colombian economy, Bogotá did not experience significant population growth until the twentieth century (see Table 8). From a base of approximately 20,000 in 1723, it took the city's population almost 150 years to double. Population growth became much more rapid beginning in the late 1800s, but the overall annual rate of increase between 1723 and 1910 was only 1 percent.

Bogotá's population increases in the post-colonial period have come from internal growth (an excess of births over deaths among the city's residents) and high levels of in-migration from rural areas and smaller cities. Foreign immigration has been numerically insignificant, although immigrants have played an important part in Bogotá's and Colombia's industrial development (Kalmánovitz, 1985).

The population of Bogotá more than doubled between 1910 and 1928, from 100,000 to 218,000, and then tripled to 660,000 by 1951. The 1950s were a time of terrible political violence in the Colombian countryside, and one result was a tremendous influx of people into the cities. From 1951 to 1964, the population of Bogotá grew at an unprecedented 7.4 percent per year. High growth rates continued into the 1970s, but by the 1985 census the city's population was much smaller than had been projected during the previous decade. Estimates of the 1985 population made in the early 1970s ranged from 5.9 million to 6.8 million, while the 1985 census figure (adjusted for missed individuals) was just short of 4.2 million. The high estimates were probably made most by extrapolation of past trends, without considering the demographic transition and the possibility of a reduction in in-migration. Lubell's (1978) estimate of Bogotá's 1975 population as 3.74 million is more puzzling, but at the actual time of writing, he may not have had access to 1973 census results.

Using a demographic model, the Bogotá Chamber of Commerce has made population projections for the period 1985-2000. They predict a 2.6 percent annual increase in population, a much lower rate than at any time since the early 1900s. The age pyramid will shift to the right, as the population on average

Table 8

Population, Land Area, and Density of Bogotá, 1560-1985

Year	Area (hectares)	Population	Annual Growth Rate (percent)	Density (persons per hectare)
1560	20	-		-
1600	56	-		-
1670	129	3,000		23
			1.5	
1800	-	22,000		-
			1.5	
1900	909	100,000		110
			3.1	
1928	1,958	235,000		120
			3.5	
1938	2,514	330,000		131
			5.5	
1951	-	660,000		-
			7.7	
1964	14,615	1,730,000		118
			5.8	
1973	30,423	2,877,000		95
			4.0	
1978	30,886	3,500,000		113
			2.6	
1985	32,866	4,176,929		127
			-	

NOTE: Blanks indicate that an estimate is not available.

SOURCE: Mohan, 1980; Bogotá, Alcaldía Mayor, 1987.

becomes older. The overall dependency ratio (children plus elderly as a proportion of total population) will decline by over 10 percent (Bogotá, Alcaldía Mayor, 1987). Assuming that these projections are approximately correct (and the demographic trends of the 1980s seem to indicate that they are), there is reason for optimism regarding the city's ability to keep pace with the growth in demand for services. A bigger challenge may be the provision of adequately remunerated employment for the capital's residents.

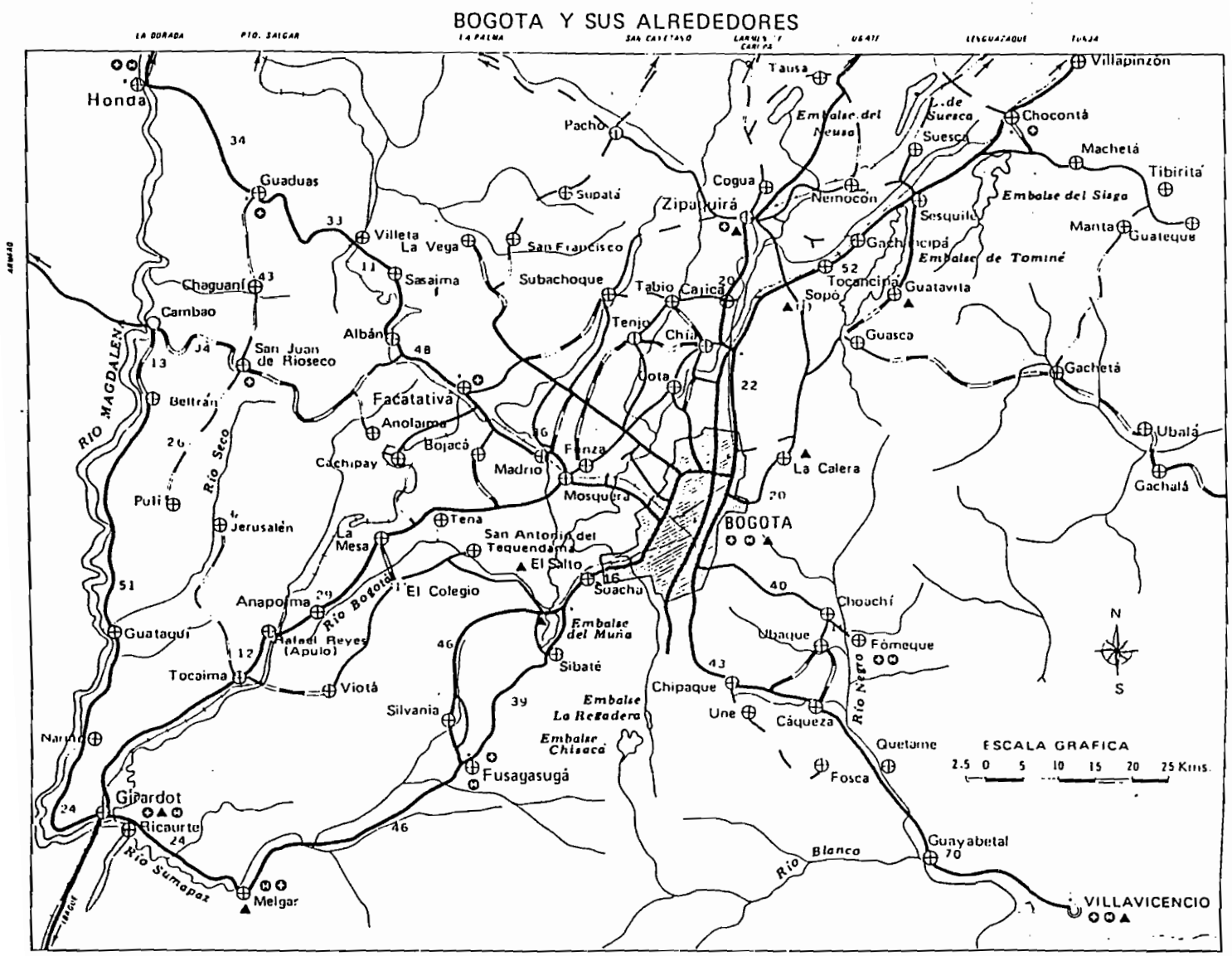
The Physical Setting and Urban Development Patterns

Bogotá is located in the central region of Colombia, at an altitude of 2,600 meters (8,530 feet) above sea level. The city sits on the southeastern edge of a mountain plain, the Sabana de Bogotá. The total area of the plain is approximately 1,650 square kilometers (Escala, 1977). As a matter of public policy, it has been declared that the absolute western limit of urbanization should be the Bogotá River, which at its nearest point is approximately 12 kilometers from downtown (Map 2). The total area east of the river which is potentially available for urban use is approximately 500 square kilometers (50,000 hectares), of which 260 square kilometers (26,000 hectares) were already developed by 1982 (Table 9). Two-thirds of the remaining available land at that time was outside the current boundaries of Bogotá. After the areas on riverbanks, with drainage problems, or reserved for industry were subtracted out, there remained 148 square kilometers of land available for urban development. This represents an area approximately 20 percent larger than the total land area of San Francisco, California.

The climate of the Sabana de Bogotá is cool and relatively dry. The annual mean temperature and precipitation (recorded at the airport) are 14 degrees Celsius (57 degrees Fahrenheit) and 61 cm. (24 in.) (Escala, 1977). Within the city itself, the combined impact of vehicle exhaust, buildings, and paved surfaces, and the shelter provided by the mountains, is to create warmer and wetter microclimates.

The impact of human settlement on the natural environment of the Sabana has been profound. When the Spanish arrived in the early sixteenth century, the area was already occupied by scattered Indian farming and hunting communities. However, the new colonists initiated agricultural and livestock production on a much greater scale, clearing extensive areas of land and introducing

Map 2. Bogotá and Surrounding Municipalities.



Source: Plano de la Ciudad de Bogotá, Bogotá: Instituto Agustiń Codazzi, 1985.

Table 9

Land Area East of the Bogotá River
Available for Urban Development, 1985
(hectares)

Total area east of the river	50,065	
Area developed up to 1985	- 25,979	
Total area remaining	24,086	
Riverbanks and wetlands	- 3,951	
Net area remaining	20,135	
within existing perimeter:	6,887	
with drainage problems:	- 1,211	
reserved for industry:	- 788	
available immediately:	4,888	(a)
outside existing perimeter:	13,248	
with drainage problems:	- 3,375	
available immediately:	9,873	(b)
Total area available immediately for urban development ((a) + (b))	14,761	

SOURCE: Bogotá, Alcaldía Mayor, 1987.

sheep, cattle, and non-native species of vegetation such as wheat and, later, eucalyptus trees. Quarries provided building materials for Bogotá and the small towns of the Sabana, while coal and salt mines supplied fuel and the means to preserve meat (Rau, 1958).

During the first 400 years of Bogotá's existence, the urbanized area of the Sabana was very small. In 1938, the total population of the plain was only 484,000, with only a little more than two-thirds of the total in Bogotá. The capital city occupied scarcely more than 25 square kilometers, 1.5 percent of the total land area of the Sabana (Rau, 1958). The ten-fold population growth of Bogotá from 1938 until the mid-1970s was accompanied by a similar increase in the city's land area. While in the poorer southeast portion of the city much of the land suffers from inadequate drainage, low soil fertility, and excessive slopes, a considerable amount of Bogotá's expansion to the west and north has taken rich agricultural lands out of production. The effort to limit the future horizontal expansion of Bogotá is a recognition of the environmental consequences of uncontrolled sprawl. At the same time, however, the reality of continued in-migration and positive net birth rates mandates that plans be made to accommodate more people. In part this can be done through the densification of both existing and future urbanized areas. As discussed elsewhere in this paper, the densification of the Colombian capital is both an empirical fact and official planning policy.

The Bogotá metropolitan area faces serious environmental problems, although the situation is much less alarming than that of Mexico City. All of the Sabana's rivers, but especially the Bogotá River, are dangerously polluted. Agricultural chemicals, household sewage, and industrial waste have also found their way into the groundwater in many areas. Air pollution is aggravated by lax emission control, although on the other hand Bogotá is favored by its low rate of automobile ownership compared with other cities of similar income levels. Bogotá produces approximately 9,720 metric tons of garbage per day, but the official garbage collection reaches only half of the population (Bogotá. Alcaldía Mayor, 1987). The slowdown in population growth has bought time for the city, but eventually these environmental problems will have to be confronted aggressively.

The Spatial Development of Bogotá

Map 3 shows the current spatial layout of Bogotá. As was mentioned earlier in this paper, Bogotá's population grew at an annual rate of only 1 percent during the period 1723-1910. By this latter date, the city contained about 100,000 inhabitants, in an area of approximately 1,000 hectares (10 square kilometers, or less than four square miles). The main trolley service was to the affluent northern suburb of Chapinero, absorbed by the city in the 1930s and now a middle-class residential and commercial neighborhood.

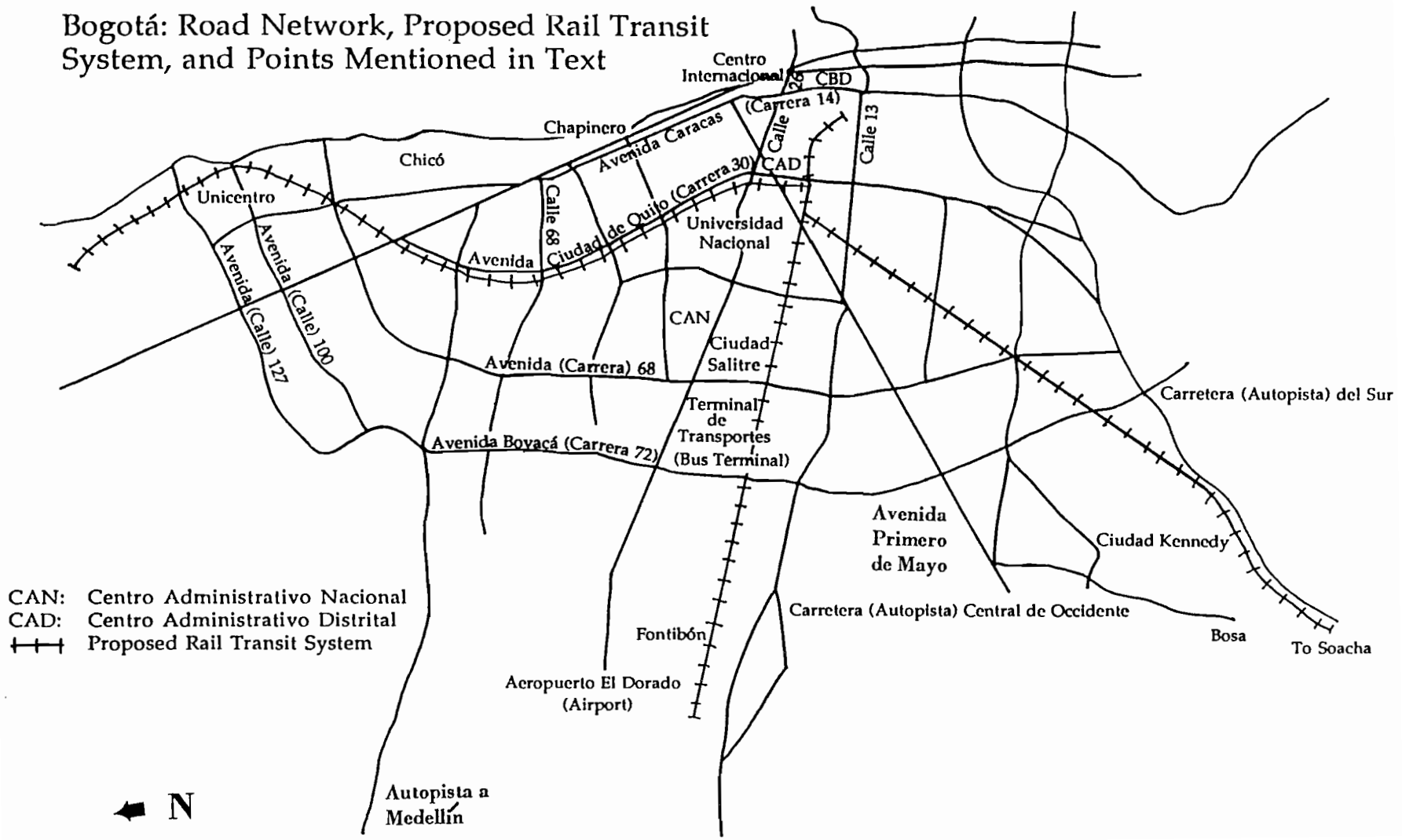
Following population trends, the land area of Bogotá more than doubled between 1900 and 1928, and then more than quadrupled by 1958 (Table 8). According to the data compiled by Mohan (1980), the population density reached a peak in the late 1950s and then declined until the mid-1970s. There is evidence, reviewed in this paper, that density changes have resulted from a process of sprawl and subsequent infill, as well as a shift from row houses to apartments among middle-class residents.

Many authors, including Amato (1968) and Mohan (1980), have repeated the assertion that the renowned architects and planners Karl Brunner and Le Corbusier played an instrumental role in shaping Bogotá's spatial patterns. Brunner worked in the mid-1930s to draw up zoning and planning regulations, while in the early 1950s Le Corbusier prepared a specific design for the city. As Mohan recognizes, however, the plans for Bogotá have generally only been effective to the extent that they follow existing market and institutional forces. Industry would probably have clustered together in the southwest part of Bogotá, even without the creation of an explicit industrial zone. Once the more affluent residents of Bogotá began to settle in the north, with its superior climate and drainage, the addition of zoning regulations merely reinforced existing spatial patterns.

Some of Le Corbusier's recommendations regarding street improvements were implemented, but his grand vision for Bogotá remained unfulfilled. As Roberto Salazar Gómez, mayor of Bogotá in the mid-1950s, confessed in an interview:

> In the case of Le Corbusier, he designed a road network, and proposed building regulations that did not exist previously. He tried to regulate subdivisions in every aspect: density, open space, heights; in general he conceived of a city designed for people living in community. However, little by little, his ideas were discarded. (In Mosca, 1987; present authors' translation.)

Map 3.


Bogotá: Road Network, Proposed Rail Transit System, and Points Mentioned in Text
Centro Internacional
CBD
(Carrera 14)
Calle 26
Calle 13
Chapinero
Avenida Caracas
Chicó
CAD
Unicentro
Avenida Ciudad de Quito (Carrera 30)
Calle 68
Universidad Nacional
Avenida (Calle) 127
Avenida (Calle) 100
CAN
Ciudad Salitre
Avenida (Carrera) 68
Terminal de Transportes (Bus Terminal)
Avenida Boyacá (Carrera 72)
Carretera (Autopista) del Sur
Avenida Primero de Mayo
Ciudad Kennedy
Carretera (Autopista) Central de Occidente
Fontibón
Bosa
To Soacha
Aeropuerto El Dorado (Airport)
Autopista a Medellín
CAN: Centro Administrativo Nacional
CAD: Centro Administrativo Distrital
Proposed Rail Transit System
N

As Bogotá grew, its upper-income residents tended to move farther north. The elite areas of the 1930s were three km. away from the center, while the new elite areas of the 1970s were thirteen km. away (Gilbert, 1978). This does not mean that upper-income groups have completely abandoned their former neighborhoods, although in 1980 there were no barrios officially classified as upper-income, and almost none classified as upper-middle-income, south of Calle 72. Income classifications are of course relative, but by any objective standard both the absolute number and the relative share of middle- and upper-income residents in the total population of the city has expanded considerably. The net result is that there are both old and new middle and upper-class neighborhoods. The old ones have experienced some deterioration, and residential use has become mixed with professional offices and small retail establishments.

Once it grew beyond a very small size, Bogotá was of course never a strictly monocentric or even "duocentric" city. What has happened in recent years, however, is that individual subcenters, mostly in the north, are becoming more self-contained and independent from the CBD. Symbolically, the year 1976 marked a major change in the city's spatial structure. This was when Unicentro, Bogotá's first North American-style shopping mall, was inaugurated. Located 70 blocks to the north of Chapinero, Unicentro when it first opened was close to the urban perimeter. The city has since expanded far to the north of the shopping center. The area around Unicentro is now occupied by intensive residential and commercial activity; nearby houses are being replaced by apartment buildings of 6-8 stories, and it is claimed that land prices in the area are the highest in the city ("Empieza el ciclo de descenso," 1988).

The last 15 years have seen a big increase in employment in the modern service sector of north Bogotá. It is not clear how significant this is in terms of number of employees, but it is clear that an increasing number of affluent bogotanos are able to carry out their daily activities without leaving the north. Certain services once available only downtown or in Chapinero (theaters, bookstores) are now well-established farther to the north, and there are even luxury hotels on Calle 100. New office construction is overwhelmingly in the north as well ("En auge mercado ...," 1988). Of course, not all the people who work in the north can afford to live there. Many employees have to make long-haul, crosstown commute trips on a bus system that is deficient for this kind of travel.

The decentralization of employment in Bogotá has been a consequence of both official policy and economic forces. A large number of government offices were moved to two sites west of downtown: the Centro Administrativo Distrital (CAD) at the municipal level, and the Centro Administrativo Nacional (CAN) at the national level. Manufacturing employment in Bogotá is moving farther away from the center. It is not clear whether or not the relocation is driven mostly by the outward expansion of the city, but the new industrial sites do offer easier transportation links to the rest of the country and to the neighborhoods where most of the workers live.

As Jaramillo (1983) points out, there is a perception by middle- and upper-income groups that the center of Bogotá is in economic decline and is being taken over by vagrants, delinquents, and street peddlers. In reality, downtown Bogotá is not booming, as will be made clear in the section of this paper on land values. At the same time, however, it would be wrong to characterize the area as the victim of the type of decline characteristic of many U.S. Central Business Districts. Downtown Bogotá is an area where different social and economic classes share the same space to a far greater extent than in most other zones of the city. There is no danger of the CBD being abandoned, but the present trend is definitely toward a greater occupation by lower-income groups. Many business and political leaders would like to see a return to a more "upscale" downtown. Proposed strategies for "recovering" (reappropriating) this space have included the construction of additional parking facilities, a rapid rail system, and the classic (largely discredited) type of "urban renewal."

In the historic area just south of Bogotá's CBD, the Banco Central Hipotecario (Central Mortgage Bank) has been involved in some controversial efforts to provide housing for a more affluent population than has traditionally lived in the zone. Continuing to the south and the west, one finds great extensions of low-income neighborhoods, with a few middle-income areas interspersed. In this area, roughly demarcated on Map 3 by the area south of Calle 13, lives over half of the city's population.

If the rail transit system planned for Bogotá and shown on Map 3 is in fact constructed, it could have a major impact on the city's spatial structure. Over the years several different route configurations have been proposed, but all involve serving Bosa and Soacha to the southwest, Fontibón to the west, and Usaquen in north Bogotá. Rather than concentrating on infill and the densifi-

cation of already-urbanized areas, spatial policy with the metro might be to create high-density "fingers" along the rail routes. In theory, the metro or else suburban rail could be extended all the way to Facatativá in the west and Zipaquirá or beyond to the north. While under this scenario it would still be possible to protect agricultural lands, development would be spilling out into areas beyond the boundaries of the Distrito Especial, the "Special District" containing Bogotá. It should be easier to control development and provide infrastructure through the present policy of channelling growth into the area east of the Bogotá River, which had an estimated additional population capacity of over four million in 1985 (Table 10). Map 4 shows the areas available for urbanization beyond the 1985 urban perimeter and east of the Bogotá River. As Table 10 shows, however, most of the population growth in Bogotá during the rest of this century can in theory be accommodated within the existing urban perimeter, through infill and densification.

As noted in the introduction to this paper, the development of subcenters in Bogotá has been accompanied by a more intense use of residential land. As part of our parallel study on the spatial dynamics of land and housing markets in the Colombian capital, we have gathered information on new formal-sector housing. Since 1984, the newspaper El Tiempo has reviewed new housing developments in Bogotá in its architectural supplement Habitar. We have compiled a data set which includes almost all of the housing projects analyzed from 1984 through the end of 1989. Each of the almost 700 observations represents a typical unit from one of 450 separate buildings and subdivisions. The number of observations is greater than the number of housing projects, due to the existence of different-sized units and multi-stage projects. Only 96, or 14 percent, of the observations are from single-family units (in Bogotá, this almost always means row houses). Not surprisingly, new single-family housing has been concentrated in the southern and western zones of the city, where land prices are lower. In the south, 43 percent of the observations in our data set represent single-family projects, while in the west, the figure is 20 percent. At the other extreme, only 2 percent of the observations from the central, east, and northeast regions are single-family. Capital is being substituted for land in housing, at the same time that the amount of space occupied by each household has declined dramatically. Hamer (1985) reported from the DANE-World Bank 1978 Housing Survey that dwelling units in unauthorized ("pirate") subdivisions had an average floorspace of 72 square meters, with a median value of between 45

Table 10

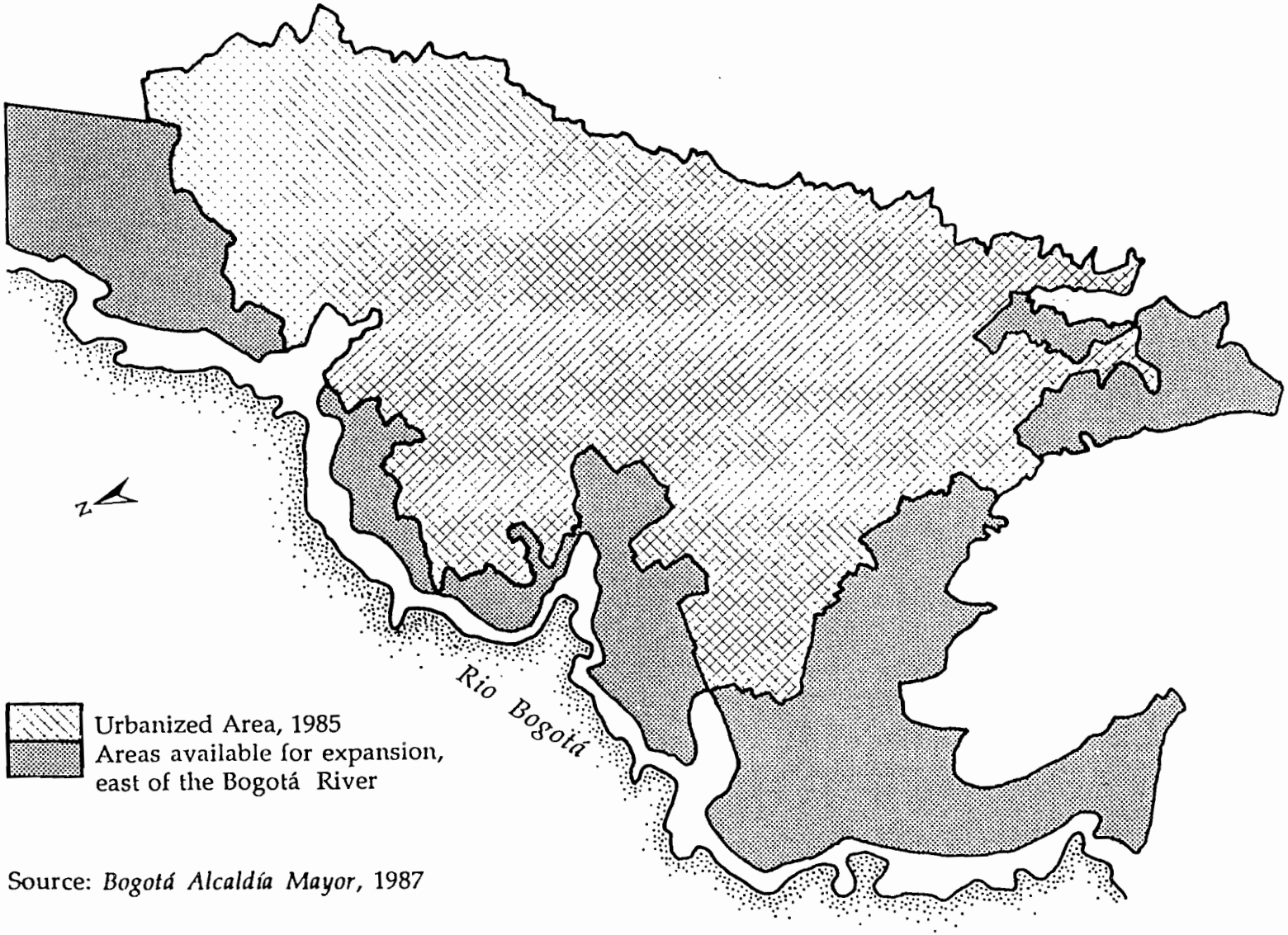
Additional Population Capacity Between 1985 and 1992, East of the Bogotá River

Area	Proposed Development Pattern	Additional Population Capacity
Areas urbanized as of 1985, which can be redeveloped at higher densities	Increase overall density of currently urbanized area from 127 to 176 persons per hectare	1,511,500
Areas not urbanized as of 1985, but available and within the current urban perimeter	Development at densities of 223 persons per hectare	1,536,000
Agricultural Areas Types III and IV (low- to medium-quality soils), Usme	Development at high densities for low-income population	249,000
Ciudad Bolivar	Development at high densities for low-income population	121,200
Luceres, Fiscala, Bosa for low- and middle-income population	Development at high densities	231,300
Agricultural areas Types II and III (low- to high-quality soils), Soacha	Development at high densities for low- and middle-income population	286,400
Joaboque, Fucha, Tintal	Development at high densities for low-income population	
TOTAL		4,080,400

SOURCE: Bogotá, Alcaldía Mayor, 1987.

Map 4.

Area Available for the Expansion of Bogotá's Urban Perimeter, 1985



Source: *Bogotá Alcaldía Mayor*, 1987

and 50 square meters. The mean area for all dwelling units in Bogotá was almost 150 square meters. The residential units in new formal-sector subdivisions and apartment buildings are much smaller. A simple average per project (ignoring the number of units) of new urbanizaciones reviewed in Habitar during the period 1984-1989 ranged from only 59 square meters per dwelling unit in the poorer south of Bogotá, to 89 square meters in the combined central-north-northeast area of the city. Housing units built under various self-help options have also declined in size since the 1978 survey. The standard lot size in new pirate subdivisions is now around 75 square meters, implying a floorspace, at least initially, of no more than 50 square meters. Minimum norm lots offered by private developers currently average between 60 and 72 square meters in size. Similarly, the Instituto de Crédito Territorial, a national government agency dedicated to sheltering the poor, offers a minimum housing "solution" consisting of a basic structure with only 26 square meters of floorspace, on a lot 60 square meters in area (Molina, 1989).

The reduction in space per dwelling unit is undoubtedly influenced strongly by changes in household structure. Household size in urban areas of Colombia has fallen considerably; as couples have fewer children, these are more likely than before to leave home before marrying, and fewer middle-class households have live-in domestic help. As has occurred in many other countries, the economic transformations taking place in Colombia have raised the opportunity cost of having children and provided employment alternatives for women who would otherwise have entered domestic service. Ceterus paribus, these changes lead individual optimizing households to demand less space. In Bogotá this effect is probably weaker than supply-side factors which push up the price of space. In any case, these two phenomena working together overwhelm any tendency for rising incomes to result in increased living area.

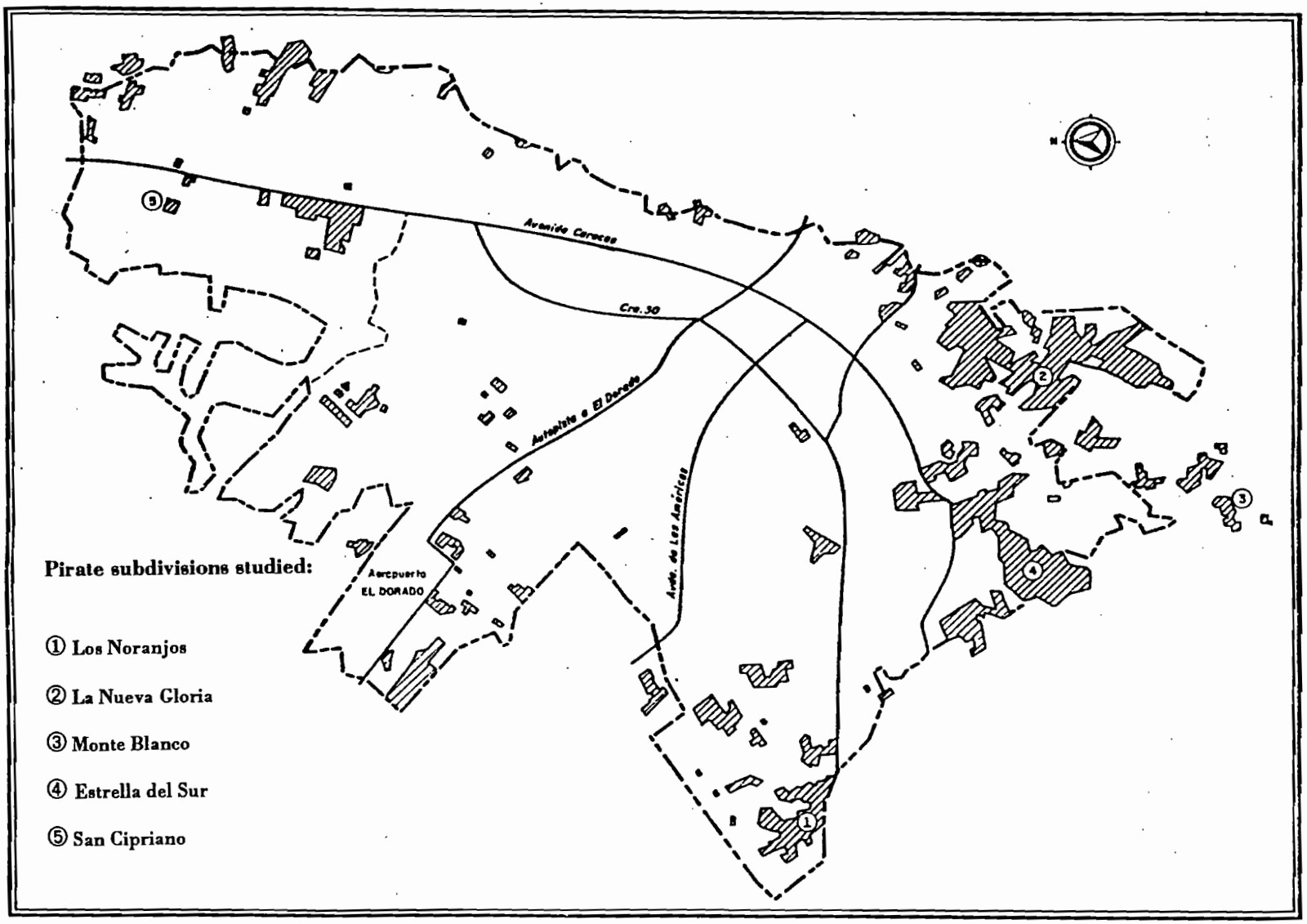
Maps, aerial photographs, and personal observation all provide clues as to where new development is occurring in Bogotá, and where there is most likely to be pressure on land markets. Because the official urban service boundary of Bogotá has been fixed by law, in theory the amount of land available for development within the city is continually declining over time. However, builders of formal-sector housing have the option of transferring their activity to nearby towns, and low-income settlements beyond the official service perimeter can either be incorporated into it from the time of their establishment (the

case of licensed minimum norm subdivisions), or can petition for inclusion at a later date (the case of pirate subdivisions that wish to be "regularized").

Within Bogotá itself, urban development in recent years has followed a pattern of outward expansion on and near major transportation corridors, and then subsequent infill. For example, comparing 1985 and 1989, we note a continued buildup of the areas along the Autopista del Norte and especially the Autopista a Medellín (see Map 3). Remaining undeveloped areas in the north, south, and west of the city, including Ciudad Salitre just west of downtown, are gradually being filled in. In addition, as discussed elsewhere in this paper, certain middle-class areas of Bogotá are experiencing densification, as houses are demolished and replaced by apartment buildings. Unfortunately, some of the most important, newer low-income settlements in Bogotá do not even appear on most maps of the city. These areas are shown as Alcaldías Menores numbers 5 (Usme) and 19 (Ciudad Bolivar) in Map 5. Most of the area of these two zones is actually outside the official urban perimeter, but has been incorporated into the city by special resolution. With the assistance of the United Nations Human Settlements Programme, the municipal administration of Bogotá is encouraging the occupation of the Ciudad Bolivar area by poor households. The difficult terrain of a great part of this zone means that valuable agricultural land is not being lost, but, at the same time, infrastructure connections are more difficult. The Ciudad Bolivar program is being presented as an extension of the "city within the city" idea, but up to the present time there are no large-scale sources of employment in the zone.

New low-income settlements in Bogotá are located mostly, but by no means exclusively, in the Usme and Ciudad Bolivar districts. Poor neighborhoods of new self-built housing are also scattered throughout the west and north of the city. In some cases the location of these barrios can be explained partially by the poor quality of the land. Two examples are some areas with poor drainage near Fontibón and the airport, and the mountain slopes above Unicentro and points farther north (see Map 3). Other new settlements of low-income households are simply extensions of established barrios populares. Poor areas in the north and west of Bogotá are often adjacent to affluent neighborhoods. This is of course a phenomenon that is repeated throughout the Third World. The presence of lower-income households in parts of north and west Bogotá appears to depress land prices. However, poor enclaves within more affluent zones are

Map 5. Location of "Pirate" Subdivisions Studied by Losada and Gómez



Source: Taken from Losada and Gómez, 1976.

generally tolerated, no doubt in part because the former provide a convenient source of low-cost service employees.

Bogotá and Surrounding Municipalities

As the national capital of Colombia, Bogotá is administered as a Distrito Especial (Special District). Bogotá is also the capital of the Departamento (state or province) of Cundinamarca. This situation is different from, for example, Mexico, where the national capital is a "Federal District" independent from the surrounding state government, whose capital is Toluca. As noted above, the service perimeter of Bogotá as decreed in the District Planning Department's Acuerdo 7 de 1979 is relatively inflexible, but areas outside the perimeter can be incorporated into the city by petition or other special arrangement. Thus, as Bogotá expands, neighboring municipalities and new low-income settlements at the periphery are absorbed into the city. Again, this is very different from Mexico, where the rigid separation between the Federal District and the State of Mexico has led to administrative anomalies such as Nezahualcóyotl, the "suburb" which in some lists figures as the country's second-largest city (Almanaque Mundial, 1986). While there are no doubt diseconomies of scale in administering such a huge area, for planning purposes the Distrito Federal and Nezahualcoyotl should be considered as one city.

Table 11 gives census population figures from 1935 to 1985 for 19 municipalities adjacent to Bogotá. These municipalities were historically rural in character; in 1938, only five of the 19 had at least one town with a population of 1,500 or greater. The towns that did exist were primarily commercial centers for the nearby agricultural areas, rather than bedroom communities for Bogotá. During the next 50 years, the situation changed dramatically. Six of the 19 municipalities became annexed to the capital, and in most of the remaining 13, the population was increasingly concentrated in the largest town. Two important corridors of population and employment leading out from Bogotá have emerged: the Autopista del Sur to the southwest, and the Carretera Central to the west (Map 3). The population concentrations of Bosa (now part of Bogotá) and Soacha (still a municipality) lie along the Autopista. Soacha had a population of over 100,000 in 1985. Data for Bosa are not available because the census report does not disaggregate Bogotá's population spatially. Nevertheless, taking existing estimates of the number of dwelling units in the area, and

Table 11

Population of Bogotá and Surrounding Municipalities, 1938-1985

Municipality	1938	1951	1964	1973	1985
Bogotá	330,312	648,324	1,697,311	2,571,548	3,982,941
Bojaca	2,011	2,137	2,617	2,982	3,744
Bosa	4,531	16,613	-	-	-
Chía	8,110	9,514	15,793	20,602	36,956
Chipaque	7,496	7,657	8,874	8,267	8,699
Choachi	7,824	10,257	11,677	10,805	11,466
Cota	1,986	2,414	4,048	4,827	8,080
Engativá	1,359	5,782	-	-	-
Facatativá	13,676	17,799	25,565	34,348	50,665
Fontibón	7,081	16,468	-	-	-
La Calera	6,180	7,319	10,933	11,807	15,309
Madrid	4,872	6,060	11,850	18,099	25,721
Mosquera	3,801	4,180	7,396	7,660	12,055
Soacha	15,159	20,441	32,600	37,753	108,670
Suba	3,105	6,062	-	-	-
Subachoque	6,942	6,789	10,075	9,614	14,005
Tenjo	4,402	4,070	6,077	6,733	8,918
Ubaque	6,860	7,437	8,634	8,547	7,437
Usaquén	4,617	11,207	-	-	-
Usme	4,497	10,794	-	-	-
Total Cundinamarca	1,174,607	1,607,910	2,819,524	3,697,190	4,750,221
Total Colombia	8,407,956	11,548,172	17,484,508	20,785,235	27,867,326

NOTE: The absence of a population figure for a municipality means that it has been absorbed into Bogotá. Refer to Map 2 for the location of the municipalities.

SOURCE: Colombia, DANE, 1986 (unadjusted 1985 census figures).

multiplying by the figure of six persons per household (reasonable for a low-income area), our estimate is that Bosa had at least 100,000 inhabitants in 1980. Soacha and Bosa serve the functions of housing both local workers and those who commute to more distant parts of Bogotá.

From its beginnings as Calle 13 in the heart of Bogotá's downtown, the Carretera Central corridor stretches for more than 35 kilometers to the west. The main towns along this highway are Fontibón (now part of Bogotá), Mosquera, Madrid, and Facatativá (Map 2). The latter three settlements had populations of approximately 10,000, 20,000, and 40,000,respectively, in 1985. In other words, the towns became larger with increasing distance from the capital. It could be implied that these towns have historically had their own growth dynamics, separate from the expansion of Bogotá. This may be changing, however. Between 1973 and 1985, the annual population growth rate of close-in Mosquera (7.7 percent) exceeded that of Madrid (4.1 percent) and Facatativá (3.8 percent). The population of Mosquera grew at more than twice the rate of Bogotá (3.7 percent), but from a base so small that the town can not yet be considered a major growth pole.

The town of Chía to the north of Bogotá is not located directly on the main highway (the Autopista del Norte), but is only three kilometers away. Chía grew at a rate of almost 5 percent per year during the period 1973-1985, as the town became an "exurban" refuge for affluent residents of the capital, as well as home to agricultural, mining, and factory workers.

As we discuss in more detail in the section on spatial structure, Bogotá's growth has clearly been more by accretion (the settlement of areas adjacent to already-urbanized zones), than by the emergence of major growth poles around the city. In 1985, not only did Bogotá contain 84 percent of the population of the Departamento of Cundinamarca; it contained fully 93 percent of the population in a metropolitan area defined by the Distrito Especial and 13 adjacent municipalities located on the Sabana.

Income Trends: Colombia and Bogotá

While Colombia has joined the group of (lower-) middle-income developing countries, averages cannot convey the hardships of those on the bottom. According to Kalmánovitz, 14 percent of the nation's workforce in 1984 was unemployed. Another 16 percent was underemployed, defined primarily as of not being able to

work the number of hours desired. Incomes in lagging regions such as Chocó are substantially below the national average, and even in "rich" Bogotá 30 percent of the population has been classified as suffering from absolute poverty (Bogotá. Alcaldía Mayor, 1987).

It is clear that Colombia experienced steady economic growth during the 1970s, but the impact of this growth on household incomes has been the subject of controversy. Urrutia (1985) quotes from sources on both the political left and right, to the effect that the economic situation of all but the richest Colombians deteriorated during the 1970s. Urrutia himself does not accept this view, and believes that those who attempt to support these pessimistic conclusions with published income data are using data which are inappropriate for time-series studies. It is worth noting that although Kalmánovitz (1985) represents a very different ideological position from that of Urrutia, his interpretation of income trends during the 1970s is similar. For Kalmánovitz, the 1970s were a period of "homogenization" of wages, with substantial increases in the official minimum wage and the earnings of rural workers, a gradual decline (6 percent over the decade) in the real wages of industrial workers, and a more precipitous fall (15 percent) in the incomes of white-collar employees.

Colombia passed through a major recession during 1979-1982. The country's economic recovery during the rest of the decade has been largely based on "non-traditional" exports--not drugs, but rather products new for Colombia, such as coal, nickel, and cut flowers. Estimates of the magnitude of drug traffic suggest that this activity was bringing $1.0-$1.5 billion U.S. annually into the country during the early 1980s. This "cushion" of reserves, as Kalmánovitz (1985) calls it, finances imports of contraband and disguises capital flight. In addition, the abundance of U.S. dollars inside the country has meant that the black market exchange rate is very similar to the official rate.

Access to Services

Gilbert and Ward (1985) compared data from the 1970s for Bogotá, Mexico City, and Valencia, Venezuela, and found that access to public utilities was greatest in Bogotá. This was true, even though the Colombian capital had the lowest per capita income (in dollars) of the three cities. From the household surveys of DANE (Departamento Administrativo Nacional de Estadística, the

government agency in charge of basic data collection), it is estimated that 8.8 percent of Bogotá's dwellings in the late 1970s did not have water connections, and 5.3 percent were without electricity. Data from the utility companies themselves show less broad coverage, but the discrepancy can be explained by taking into account "pirate" (unauthorized) utility connections.

While on the surface the figures regarding access to water and electricity look impressive, there is still cause for concern. First of all, the low percentage of the population without these basic services still translates into very large numbers. Using a 1980 estimate of 541,705 dwelling units in Bogotá (Colombia. DANE, 1980), and the citywide average of six persons per dwelling, the implication is that 286,000 persons in the Colombian capital lacked proper water connections and 172,000 were without electricity. Furthermore, water connections are becoming increasingly difficult to supply to new low-income subdivisions, as the latter expand onto higher-elevation hillsides (Bogotá. Alcaldía Mayor, 1987). The issue of provision of public services to "pirate" (unregulated) subdivisions is discussed later in this paper.

The scale of telephone service in Bogotá is impressive; in 1987 there were 835,000 subscribers. The management of the (municipally-run) telephone company had plans for installing 300,000 additional private lines by 1991. If carried out, this plan would give an average of at least one telephone line per household in Bogotá. In addition, the Colombian capital had 13,000 public telephones in 1987, with an increase to 24,000 planned for 1990 (Bogotá. Alcaldía Mayor, 1987).

Sanitation presents a great challenge in the Colombian capital. No more than 50 percent of the city's garbage is picked up by EDIS, the sanitation agency of the Special District. Some of what is not picked up is recovered by small-scale recyclers. The rest is either disposed of illegally, or hauled by private individuals to the city's dumps.

Because of Bogotá's privileged position as the political, cultural, and economic capital of Colombia, the city does not suffer an absolute shortage of trained medical personnel. It has been estimated that, considering only the five hospitals administered by the Social Security of Bogotá, with the existing number of "doctor hours" worked, it would be possible for every resident of the capital to have an annual consultation (Bogotá. Alcaldía Mayor, 1987). The fact is, however, that medical care in Bogotá is distributed very unequally, according to income and the type of employment. Informal-sector and self-

employed workers who cannot afford the normal fees of private medical care are largely dependent on charity.

Education in Bogotá has been marked by great progress at both the most basic and more advanced levels. Illiteracy has been reduced to less than 4 percent of the population ages 10 years and older, and 93 percent of the population ages 7 to 11 is enrolled in school. At the secondary level the coverage drops, but still, 80 percent of all children ages 12 to 17 are in school (Bogotá. Alcaldía Mayor, 1987).

Thus far we have discussed general economic and social conditions in Bogotá. We now turn to the main topic of the paper, land and housing markets in the Colombian capital.

THE STRUCTURE OF LAND AND HOUSING MARKETS IN BOGOTA

Formal versus Informal Land and Housing Markets

Analyses of economic activity in developing countries often make a distinction between "formal" and "informal" sectors. While the concept of informality has attracted considerable attention from scholars, there are problems with considering it a separate economic category. The elements of informality can include poorly-developed capitalist relations among buyers and sellers, primitive technologies, and, especially, a failure to operate within the established legal framework. There is a tendency to use the term "informal" for economic activity which takes place among the low-income population. However, writers such as Perlman (1976) and De Soto (1989) reject the idea that participants in the so-called informal economy are a backward, marginal group. We concur, and, for the purposes of this paper, informal land and housing markets are defined as those which function without being bound by all the legal and institutional constraints which in theory are supposed to regulate them. Informality in Bogotá's land and housing markets takes the form primarily of land supplied in "pirate" (i.e., unregulated) subdivisions, combined with unregulated self-help construction.

While the legal and institutional contexts for formal versus informal activity in land and housing markets are different, each system operates under a similar economic logic of utility and profit maximization. However, while informal-sector residential construction usually (but not always) involves

individuals building shelter for their own, immediate use, formal sector housing construction in Bogotá is largely "speculative," i.e., it is built by developers in order to earn a profit, but with no particular client in mind.

Land Ownership and Supply In studies of land markets in developing countries, one frequently finds the allegation that a few large developers/speculators are exerting monopoly power, withholding land from the market in order to drive up prices of both land and housing. Dowall (1988) found that, although this was the accepted wisdom regarding Bangkok, the empirical data did not support this conclusion. Studies in Colombia have similarly attributed high housing prices to the characteristics of land markets:

> There is not one commentator on the problem of housing in Colombia who does not in some way blame the high building costs to a greater or lesser degree on the price of land, and of course, who does not make the connection [between the high costs and] the housing deficit. Robledo, 1985 (present authors' translation)

As we shall see later in this paper, it is not entirely clear from the available evidence that land prices in Bogotá have increased as much in real terms as some have claimed. Even if this were the case, however, Robledo's explanation for the price increases (monopolistic land ownership) cannot be accepted without further study. Robledo quotes Molina's (1979) work which found that 70 percent of the land in the Special District of Bogotá was in the hands of 1 percent of the landowners. However, what Robledo does not mention is that once lots of greater than 6,400 square meters (mostly rural) were eliminated, concentration was reduced to 20 percent of owners having 50 percent of the land. As in any city, there are in Bogotá large tracts of land in the hands of governmental and quasi-governmental agencies. Probably the largest single tract of undeveloped land within Bogotá's boundaries is an area of 230 hectares, almost one square mile, owned by the Beneficencia de Cundinamarca, a quasi-governmental charitable organization. It is on this land that the Ciudad Salitre project is being developed.

Land and housing markets are tightly linked, and the distinction between the two blurs when, as often occurs in Bogotá, a single corporation acquires a large land area and controls all aspects of development. More research is needed on the concentration of land ownership in Bogotá, and the dynamics of land transactions for formal-sector housing. Of particular interest is how

very large parcels are assembled. Moderate-size apartment developments require at least several thousand square meters of land. Less than 3 percent of the land transactions studied by Mohan and Villamizar (1982) and Wagner (1984) involved parcels of 10,000 square meters (approximately one square block) or greater. Wagner found that large parcels were often sold at a discount when located beyond the urban fringe, but could command a premium when within an urbanized area.

In our sample of new housing developments in Bogotá, the size of the projects varies greatly, from a single building with only five apartments, to the gigantic Ciudad Tunal project with 7000. The lowest quartile of the project size distribution covers up to 20 housing units, while the second quartile extends up to the median value of 40. Around three-fourths of the projects have 100 or fewer housing units. There are 20 observations, representing 16 different projects, with more than 1,000 units. Eight of these projects are single-family.

The pattern which emerges from the data is that the majority of the projects and their developers are relatively small-scale, but the majority of the housing units are in large projects. The 16 projects of 1,000 or more units include four which have been built and sold by the Organización Luis Carlos Sarmiento Angulo (OLCSA), one of the largest private residential developers in Bogotá. (Advertisements for OLCSA claim that one out of 50 residents of Bogotá lives in a dwelling built by them.) One of the 16 projects is being sold by the Instituto de Crédito Territorial (ICT), the national government agency in charge of providing shelter for low-income households. Two of the projects are from the Banco Central Hipotecario (BCH), a similar agency for middle-income households. One project corresponds to another large developer, Pedro Gómez, and one to a cooperative association for self-help housing.

It is normally difficult to assemble very large land parcels in already built-up areas, and, as might be expected, the largest projects tend to be located in more peripheral locations. On Map 3, these would be indicated roughly by the area to the right of the Autopista del Sur, below Avenida Boyacá, or to the left of Avenida 127. Two large projects which have been built inside this perimeter are Metrópolis and Sauzalito. Metrópolis is a residential and commercial development which occupies approximately 7.5 hectares of land on Carrera 68 just north of Calle 68 (see Map 3). The area surrounding the project has for decades been occupied by working-class housing, but in the mid-

1980s the firm Pedro Gómez y Compañía created a middle- to upper-middle-class "city within the city" on the site. Sauzalito is the first stage of Ciudad Salitre, the ambitious plan by the Central Mortgage Bank (Banco Central Hipotecario--BCH) to develop the large parcel of land referred to above.

The high cost of housing is often blamed on land speculation, a term which has precise meanings, but which in popular use tends to refer to simply to the act of holding on to land in the expectation that its price will increase. Several persons knowledgeable of the Bogotá real estate market have remarked to the authors of this paper that developers in the Colombian capital do not hold on to land a long time before building, because the opportunity cost of the investment is too high. In 1988, commercial interest rates reached 38 percent for deposits and 45 percent for loans. These figures compare with an inflation rate of 24 percent in 1987. Especially when transaction costs and risks are considered, developers are better off putting their money in the bank than holding on to undeveloped land. In fact, because almost all formal sector building in Bogotá is "speculative" (as opposed to "on demand"), developers find it necessary to build the structure and sell or lease it quickly, in order to pay back loans used for land purchases and construction. This scenario does not rule out the possibility of speculative behavior by intermediate purchasers of land, but it may provide a clue as to why there are few large vacant parcels held by developers in built-up areas of Bogotá.

The relationships between land markets and low-income housing in Bogotá have been the object of more careful study. Many researchers have commented that the Instituto de Crédito Territorial (ICT), the government entity in charge of shelter for low-income households, has tended to build its projects at the urban fringe. This saves on land costs, but at the same time necessitates costly extensions of infrastructure and encourages sprawl onto valuable agricultural lands.

It is claimed that up to half of the households in Bogotá occupy structures which have their origins in "pirate" (i.e., unregulated) subdivisions (Mohan, 1985). We discuss the construction process in these subdivisions in the section on housing. What is of interest here is how the land is acquired by a developer, subdivided into lots, and sold to prospective homeowners. The clandestine subdivisions of Bogotá have attracted considerable attention, no doubt in part because they provide a marked contrast with land invasions, the characteristic housing solution of the poor in many other cities of the

developing world. Relevant studies include Gilbert and Ward (1985), Losada and Gómez (1976), Doebele (1975), Lubell and McCallum (1978), Vernez (1973), Carroll (1980), and Hamer (1985).

Pirate, unregulated, and clandestine subdivisions all refer to the same thing. The terms describe subdivisions which are developed without the required permits. Normally the lots do not initially have services, and the history of clandestine subdivisions is one of struggles with municipal authorities over the provision of water and electricity.

As Hamer points out, unregulated subdivisions in Bogotá have a series of characteristics which "generally occur together" (p. 2). The vacant land is usually at or beyond the urban fringe, but given Bogotá's irregular shape, this does not necessarily imply that the land is far from the CBD. In fact, much of the informal sector development in Bogotá is taking place only 5-8 km. from the heart of downtown. The land used for clandestine subdivisions is generally all or part of a former rural estate. In many cases the land is not well-suited for crops, because of the steep terrain, poor soils, and/or drainage problems. The foothills to the southeast of downtown are a good example. Before being converted into low-rise, higher-density housing, they were used primarily for grazing. Other clandestine subdivisions have been established on more valuable agricultural land. However, it would be unjust to blame the residents of pirate subdivisions for the loss of farmland in the Sabana de Bogotá. Land allocation is a market process, and while low-income households may outbid agriculture for the right to occupy a territory, the areas of Bogotá with the best soils and drainage, and the most sunlight, are more likely to be occupied by formal-sector housing than pirate subdivisions.

The developer of the unregulated subdivision sells the lots, often on an installment plan, to individuals who will either resell them as is, or build on them and then sell or occupy the structure themselves. Survey data reported by Hamer (1985), and corroborated by other studies done around that time, gave an average of approximately 160 square meters as the size of the lots in clandestine subdivisions. The theoretical maximum density with lots of this size is 62.5 dwelling units per hectare, or 6,250 per square kilometer. Assuming an average of five persons per household, the population density would be 372.5 per hectare, or 37,250 per square kilometer. If 20 percent of the land in a subdivision were used for non-residential purposes, the density would still be 298 per hectare, or 29,800 per square kilometer. Amazingly, this is still about

15 percent higher than the reported density for Manhattan in 1986 (United States Department of Commerce, 1987). It is also more than two-and-one-half times the overall density of Bogotá reported for 1978 (Mohan, 1980). Our example is perhaps an extreme one. Clearly, however, the kind of clandestine subdivisions which blanket much of southern Bogotá are achieving a very high utilization of the land, without the capital expenditures required by buildings more than two stories high. The fact that lot sizes in pirate subdivisions have been declining in recent years (Molina, 1989) gives further support to our argument.

As Carroll (1980) discusses, the illegality of the subdivision usually prevents residents from obtaining a legal deed. However, under Colombian law, a sales contract is sufficient for the land to change hands (Hamer, 1985). Losada and Gómez found that almost half of the sales contracts had not been duly registered, but on the other hand Hamer and Carroll found that, in general, insecurity of tenure did not seem to be a problem within the pirate subdivisions.

Land Invasions

Land invasions are quite rare in Bogotá, in comparison with other Latin American cities such as Lima, Santiago, and Caracas. In these latter cities, invasions have frequently taken place on state-owned lands which are far from the center and which have little agricultural potential (Gilbert and Ward, 1985). In some cases, permitting land invasions is a form of clientelism on the part of the state: a strategy to win political support from the poor. In and around Bogotá, on the other hand, the publicly-owned land that exists is generally too valuable for the state to want to relinquish it voluntarily. The police have usually moved quickly to dislodge the participants in land invasions, with the result that only 1 percent of the households in Bogotá live in squatter settlements (Valenzuela and Vernez, 1972). Janssen (1984) lists the more notable cases of land invasion in the Colombian capital. According to him, the first large-scale invasion in Bogotá occurred in 1961, in a neighborhood to the southeast of downtown, later known as Las Colinas. The same year, a gradual invasion of land began to take place on a nearby site behind La Hortua Hospital, which is located on Avenida (Calle) 1 near Avenida Caracas (Carrera 14). This settlement was the site of a violent confrontation with the police in 1966, as a result of which two children and two adults were killed, and around 100 persons were wounded. On official maps the neighborhood is referred to as La

Sevilla, but to residents of Bogotá the area is known as Policarpa Salavarrieta, after a heroine of the war of independence from Spain.

At the time Janssen was writing (mid-1970s), there were eight other Bogotá neighborhoods which had their origins in land invasions. Most of these settlements occupy lands unsuitable for formal-sector housing, generally in mountain foothills. This explains why most of these invasions were subject to little police interference. It is when squatters occupy sites which have potential for "market" housing (such as Policarpa Salavarrieta) that the official response is swift and severe.

Service Provision: Formal, Pirate, and "normas mínimas" Subdivisions

Regulated or "formal-sector" subdivisions by definition are only built if they receive the infrastructure necessary for their functioning. Bogotá has an effective mechanism to pay for infrastructure, the valorization tax. This is a fee charged to property owners in proportion to the increases in the value of their property when services are provided. The valorization tax can help to pay for the infrastructure. In practice it has been used mostly to fund roads and sewers, and for improvement projects, rather than for servicing newly urbanizing areas.

Pirate subdivisions in Bogotá have presented municipal and national authorities with a dilemma. On the one hand, these settlements are providing needed housing that private developers and the state itself has been unwilling or unable to supply. On the other hand, however, the subsequent political battles over service provision, the environmentally unstable locations chosen for many of the barrios clandestinos, and the low quality of much self-built housing have all pushed the government to look for alternatives to the traditional urbanizaciones piratas.

The minimum norm subdivisions administered by private developers, and the self-help housing program of the Instituto de Crédito Territorial (both described later in this paper) are efforts to exert control over settlement patterns with a minimum of commitment of government resources. Because both kinds of projects are often located in peripheral areas, extension of even minimum services is expensive.

In general, service provision has not been a barrier to urban development in Bogotá. Developers of formal-sector subdivisions share with the utilities

the costs of connecting the housing units with services. Rarely if ever are these developers unable to carry out their projects because the utility will not extend its lines to the edge of the property (Cuervo, 1989). Minimum norm developments, whether sponsored by government agencies or private interests, are built with the understanding that basic services will provided. Finally, "pirate" subdivisions spring up independently of the availability of infrastructure. In no case does it appear that a failure to expand basic services fast enough is actually retarding the growth of the city.

The Evolution of Land Prices in Bogotá

Land Prices--General Considerations

Most empirical studies of urban dynamics rely heavily on analyses of land prices to understand the changes occurring in a metropolitan area. These analyses generally involve simple mathematical calculations of average land prices and percentage changes over time. Whether rising or falling land prices are "good" or "bad" depends partly on the redistributive consequences, partly on whether the change appears to be the result mostly of changes in demand or supply. An intuitive reaction is that "good" land price increases are usually those that result from strong demand, while "good" land price decreases are those that are brought about by expanding supply. A shift out in demand of course gives an unambiguous increase in producer surplus, while consumer surplus is greater, less, or unchanged, depending on the elasticity of supply. Likewise, a shift out in supply gives an unambiguous increase in consumer surplus, while the effect on producer surplus can be in any direction. In both cases that we have labelled "good", the actions of agents on one side of the supply-demand equation have a beneficial effect on the other side.

As will be emphasized later in this paper, there is no one correct way to calculate an average land price or rate of change over a heterogeneous urban area. Most actual sales of land at a particular moment in time are usually taking place in peripheral locations. The absolute level of land prices is normally lower here than in more central areas, but while prices in the center may be stagnant or declining in real terms, those at the periphery are likely to be increasing rapidly. Any estimate of an average price or rate of change

will be highly sensitive to the way in which individual price observations and zones of the city are weighted.

Because our ultimate aim in studies of land prices is to understand how they relate to patterns of land use, it is useful to estimate quantitative relationships which combine this information. Density and rent gradients, along with land-capital substitution elasticities, are three related measures used to analyze land prices and spatial structure. Density gradients are a measure of land use intensity as a function of distance from an activity center, while rent gradients show how land prices change with distance. The elasticity of substitution between capital and land is similar to a ratio of the density and rent gradients. What the elasticity shows is how the intensity with which land is used varies as the land price (or more correctly, the ratio of the land price to the capital price) changes. After reviewing the existing published work on land prices in Bogotá, we shall examine rent gradients in the Colombian capital, and will also present preliminary estimates of the land-capital substitution elasticity.

Land Price Studies in Bogotá--a Review

The documentation on land prices in Bogotá includes McCallum (1974), Losada and Gómez (1976), Molina (1979), Mohan and Villamizar (1982), Villamizar (1982), and FEDELONJAS (1988). These studies cover a period of almost thirty years, allowing both cross-sectional and time-series views. The scope of the studies ranges from the small survey conducted by Losada and Gómez in five pirate subdivisions, to Mohan and Villamizar's work utilizing 6,200 land price observations spanning 24 years and the entire city, to the monumental FEDELONJAS study covering the 30 years 1959-1988, also city-wide and based on 15,000 observations for the last ten years alone. The following sections review each of these studies and compare their estimates of land prices in order to determine the consistency of their results.

McCallum

McCallum's (1974) article is a short report on trends in land values in Bogotá for the period 1962-1972. McCallum uses real estate data for the years 1962-1970, and then projects two years ahead. The robustness of his findings

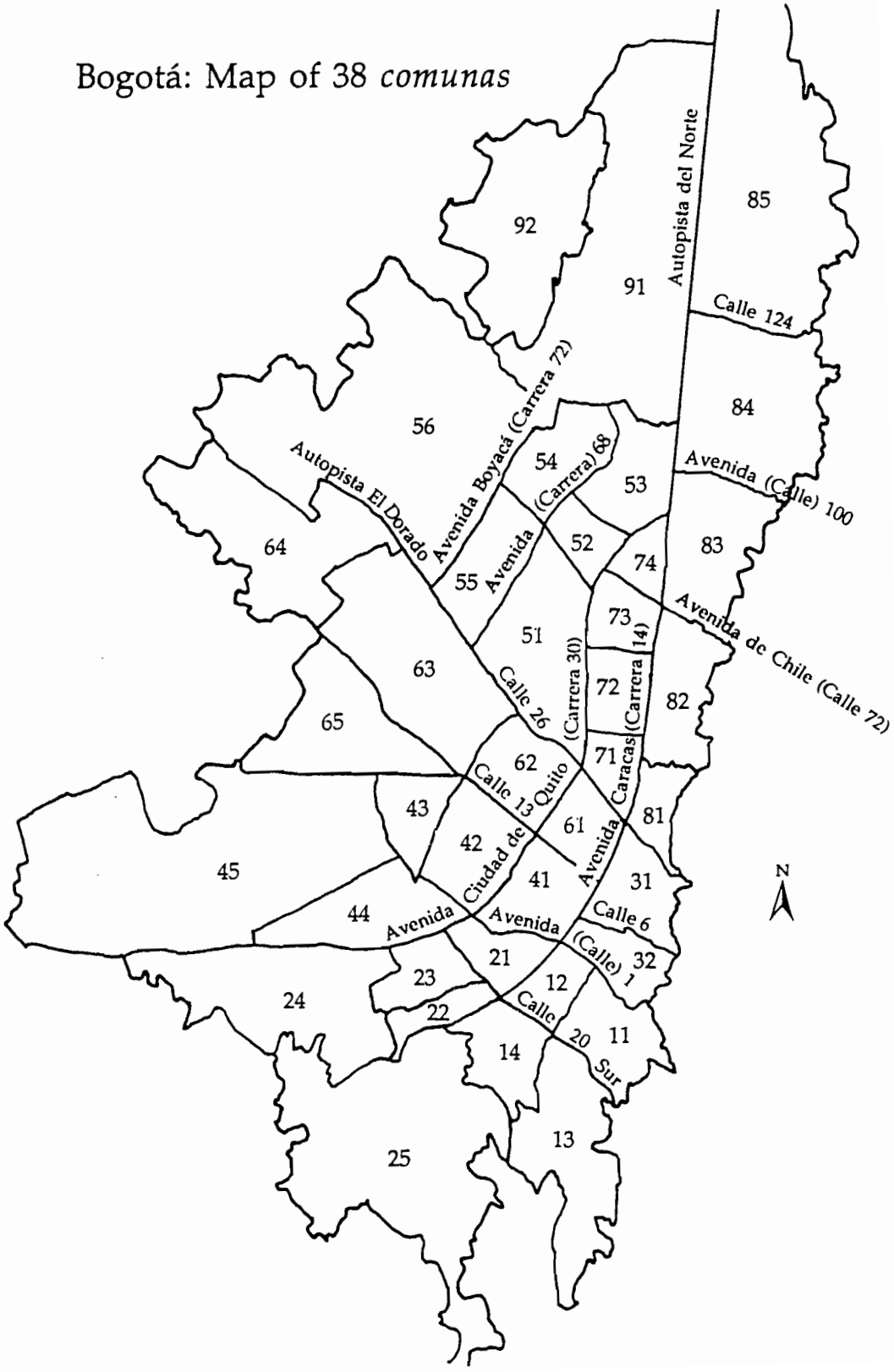
is weakened by the sparseness of the data, particularly in poorer sections of the city and in new middle-class zones at the periphery. Nevertheless, McCallum's results do support the view that as the city expands, the gradient of land prices extending from the center of the city will become less steep. The downtown and many nearby areas experienced stagnant or declining land prices in real terms during the period 1962-1970, while most peripheral areas underwent price increases. At the same time, however, the absolute level of land prices was highest in the downtown. The estimated 1972 land value for the central zone was more than three times that for the area with the next-highest land values, the Centro Internacional a few blocks to the north of downtown. One striking finding of McCallum's analysis was that some low-income areas adjacent to downtown had extremely low land values, less than one-tenth the level of the center. An analysis of Mohan and Villamizar's more extensive data set does not support such extreme conclusions.

Losada and Gómez

Data on informal-sector land transactions are usually not available from conventional sources, such as the assessor's office or real estate firms. Fortunately, Losada and Gómez (1976) include an analysis of land prices in their study of "pirate" subdivisions in Bogotá. The data come from a survey of 101 property-holders conducted in April 1975 in the subdivisions of La Nueva Gloria, Monte Blanco, San Cipriano, Estrella del Sur, and Los Naranjos (Map 6). The average lot size ranged from 130 square meters in Nueva Gloria to 172 square meters in Estrella del Sur. These numbers are consistent with survey results (Hamer, 1985) which found that two-thirds of the lots in clandestine subdivisions were between 100 and 200 meters in size. If Hamer's figure of 72 square meters of floorspace per dwelling unit in pirate subdivisions is also typical of the neighborhoods studied by Losada and Gómez, then on average the dwellings cover up to half of the lot. In reality, construction in clandestine subdivisions is done in stages, and structures in their more advanced stages are often two or even three stories tall.

There was a wide variation in the initial price paid for land in the five clandestine subdivisions studied by Losada and Gómez. In 1975 pesos, the price per square meter ranged from 89 in Monte Blanco to 228 in San Cipriano. The ranking of subdivisions according to their average land price very closely

Map 6.


Bogotá: Map of 38 *comunas*
Autopista del Norte
Calle 124
Avenida Boyacá (Carrera 72)
Autopista El Dorado
Avenida (Carrera) 68
Avenida (Calle) 100
Avenida de Chile (Calle 72)
Calle 26
(Carrera 30)
(Carrera 14)
Calle 13
Quito
Caracas
Ciudad de
Avenida
Avenida
Avenida
Calle 6
(Calle) 1
Calle 20 Sur
N
85
92
91
84
56
54
53
64
55
52
74
83
51
73
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43
61
81
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45
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25

followed the income ranking. However, the income difference between the richest (La Nueva Gloria) and the poorest (Monte Blanco) neighborhoods was less than 25 percent, so incomes alone do not adequately explain the land price differences. Location and the inherent characteristics of the land are more likely explanatory variables. The more expensive land (San Cipriano to the north, Los Naranjos to the southwest) is in areas with flatter topography and better drainage. Not coincidentally, these two subdivisions are in closer proximity to middle-class neighborhoods than La Nueva Gloria, Estrella del Sur, and Monte Blanco, all of which are part of the huge agglomeration of low-income neighborhoods which extends over the foothills to the south of the city. Losada and Gómez do not provide exact information on when each pirate subdivision in their study was settled, but they imply that the lots were sold to proprietors in the early 1970s. San Cipriano had the best infrastructure connections at the time of the survey. This might have been a reflection of a longer period of settlement, except that this should have meant that the initial price of land in San Cipriano should have been one of the lowest, instead of the highest.

Molina

Molina (1979) presents extensive information on land prices in Bogotá, based on data from the cadastre and unpublished listings from a local realtor. Molina's emphasis on the role of distance from the CBD as a determinant of land values is somewhat surprising, given the generally critical nature of his book. On the other hand, however, his data are from the early 1970s, when Bogotá was a much more monocentric city than now. Molina estimates land value gradients emanating from the center, but since in reality the prices do not decline smoothly with distance from the CBD, he also lists the actual coordinates. In addition, Molina does a detailed analysis of prices along the Avenida Jiménez, a major East-West route leading out of downtown. His calculations are compared with prices from the data set used by Mohan and Villamizar in Table 12. Finally, Molina concludes with an evaluation of the returns to land compared with those of selected savings instruments, for the period 1962-1970. His choice of location for a time series of land values is unfortunate, since he uses an 18-block area in the heart of downtown. Even at this early date, this was a zone of stagnant and even declining real land values, and thus it is not surprising that fixed-term savings deposits, Central Mortgage Bank certificates, and a

Table 12

Comparison of Bogotá Land Price Data:
Molina; Mohan and Villamizar
(Avenida Jiménez, Commercial Areas, 1970)

Distance from CBD (km.)	1970 Land Price (Pesos/M2) Molina	Equivalent or Adjacent Street Address	1970 Price for Land at This Address, Mohan and Villamizar
0.0	1,554	Carrera 8, Calle 13	3,125*
1.7	1,557	Carrera 16, Calle 12	1,250
2.5	650	Carrera 32, Calle 10	234
3.4	1,500	Carrera 36, Calle 10	234
3.8	280	Carrera 40, Calle 10	250
10.2	230	Carrera 8, Calle 10, in Fontibón (street now renumbered)	203
11.0	221	"	203
13.8	214	no data	

*Highest 1970 land value in World Bank data set; most observations in Comuna 31 (traditional downtown) had a land value of less than 1,000 pesos).

SOURCES: Molina 1979; authors' calculations from World Bank Bogotá land price data.

composite industrial shares index all out-perform land prices for the period under study. Molina's analysis of land prices in Bogotá includes a map with radial lines emanating from the CBD and representative land prices indicated along these lines. Unfortunately, neither the text nor the map indicates the precise location of the data points, or the years for which the values were calculated, making a comparison with the World Bank data difficult. We can say with confidence, however, that the values given in Molina's map are of roughly the same magnitude as the World Bank data set's 1970 prices. Molina shows land prices highest in the CBD and generally declining with increasing distance from downtown. This is true of the main north-south corridor, a situation which has apparently completely reversed itself, according to a recent FEDELONJAS study to be discussed shortly.

Mohan and Villamizar

Until the work by FEDELONJAS (1984, 1988), the most comprehensive study of land prices ever done in Bogotá involved a set of 6,200 observations covering the period 1955-1978. The original source for this information was the real estate firm of Wiesner y Compañía in Bogotá. However, the data analysis was carried out under the auspices of the World Bank's Bogotá City Study, a large and multi-faceted research project undertaken with the collaboration of the Corporación Centro Regional de Población. The results of this land price study have been reported in the papers by Mohan and Villamizar (1982), and Villamizar (1982). Much of the analysis in these two papers is at the comuna level. Comunas are 38 districts into which the city has been divided. Map 6 shows the comuna boundaries.

The paper written jointly by Mohan and Villamizar emphasizes the relationship between residential densities and land prices. Density gradients are calculated using population figures at the neighborhood level, which in turn are estimated from census data (1964, 1978) and City Study projections (1973). Land price gradients are calculated from comuna averages for the years 1959, 1965, 1973, and 1977. The equations are:

$$D(k) = D_o e^{-gk}$$

for density; and

$$V(k) = V_o e^{-hk}$$

for land value, where e is the natural logarithm, and k is the distance in kilometers from the center. The coefficients g and h measure the rate at which densities and land values, respectively, decline with increasing distance from the center.

The density equation is estimated for three different years, with the following results:

Year	No. of Observations (Neighborhoods)	Estimate of do, Density at Center (1000s/ sq. km.)	Actual Density at Center	Estimate of g, the Slope of the Density Gradient	r^2
1964	292	23	22	.18	.12
1973	453	27	18	.15	.22
1978	465	24	17	.12	.19

Density functions normally overstate actual population densities in CBDs, since downtowns are usually dominated by commercial and office uses rather than residential activity. High residential densities are likely to occur just outside the CBD. The gradients estimated for Bogotá do predict higher densities in the CBD than the actual ones. In addition, the low r^2 values are an indication that the overall statistical fit is poor. In other words, densities do not decline smoothly with increasing distance from the CBD.

Mohan and Villamizar's land value function is estimated for four different years, and gives the following results:

Year	Estimate of Vo, Price of Land in the Center, in 1955 Pesos per Square Meter	Actual Value Land in Center	Estimate of h, the Slope of the Land Price Gradient	r^2
1959	2400	6300	.18	.56
1965	2500	5600	.15	.55
1973	1900	5300	.08	.39
1977	1760	4300	.07	.35

(Calculations done using the average land value for each of Bogotá's 38 comunas.)

The estimated function gives much lower land values in the center than the actual ones. The intense office and commercial activity drives land values to a very high level within a fairly restricted area. The calculated gradient function gives a line which is too low at the origin (i.e., in the CBD), and too high away from it. The situation is further complicated by the fact that there are some areas adjacent to the CBD that have fairly low land values. These are mostly low-income residential areas that cannot readily be "renewed" or converted to more intense uses.

Mohan and Villamizar's land value functions exhibit a decreasing steepness over time, but are still strongly negative. The declining r-square is a clearer indication that the monocentric model is becoming less relevant. It is of interest to note the trend in the ratio of the density gradient to the rent gradient:

Year	Density Gradient (g)	Rent Gradient (h)	Ratio g/h
1964	.18	-	1.2
1965	-	.15	-
1973	.15	.08	1.875
1977	-	.07	-
1978	.12	-	1.714

By the early 1970s, there is a considerably greater difference between the two gradients than during the mid-1960s. In all cases, but especially in more recent years, density is falling faster than land values as we move away from the center.

Mohan and Villamizar present a very useful table (Table 13) of average household income and housing characteristics, disaggregated by both concentric rings around the CBD, and pie-shaped wedges emanating from the center. The delineation of the rings and wedges ("sectors") is shown in Maps 7 and 8. Looking at the rings, as we move away from the center, housing is newer, less tall, and more likely to be single-family. Ring One has the lowest average income and the lowest average dwelling space per person. All of this is consistent with the Alonso-Muth-Mills type of models. In fact, the location of the poor near the center is similar to the U.S. experience, and contrasts with the

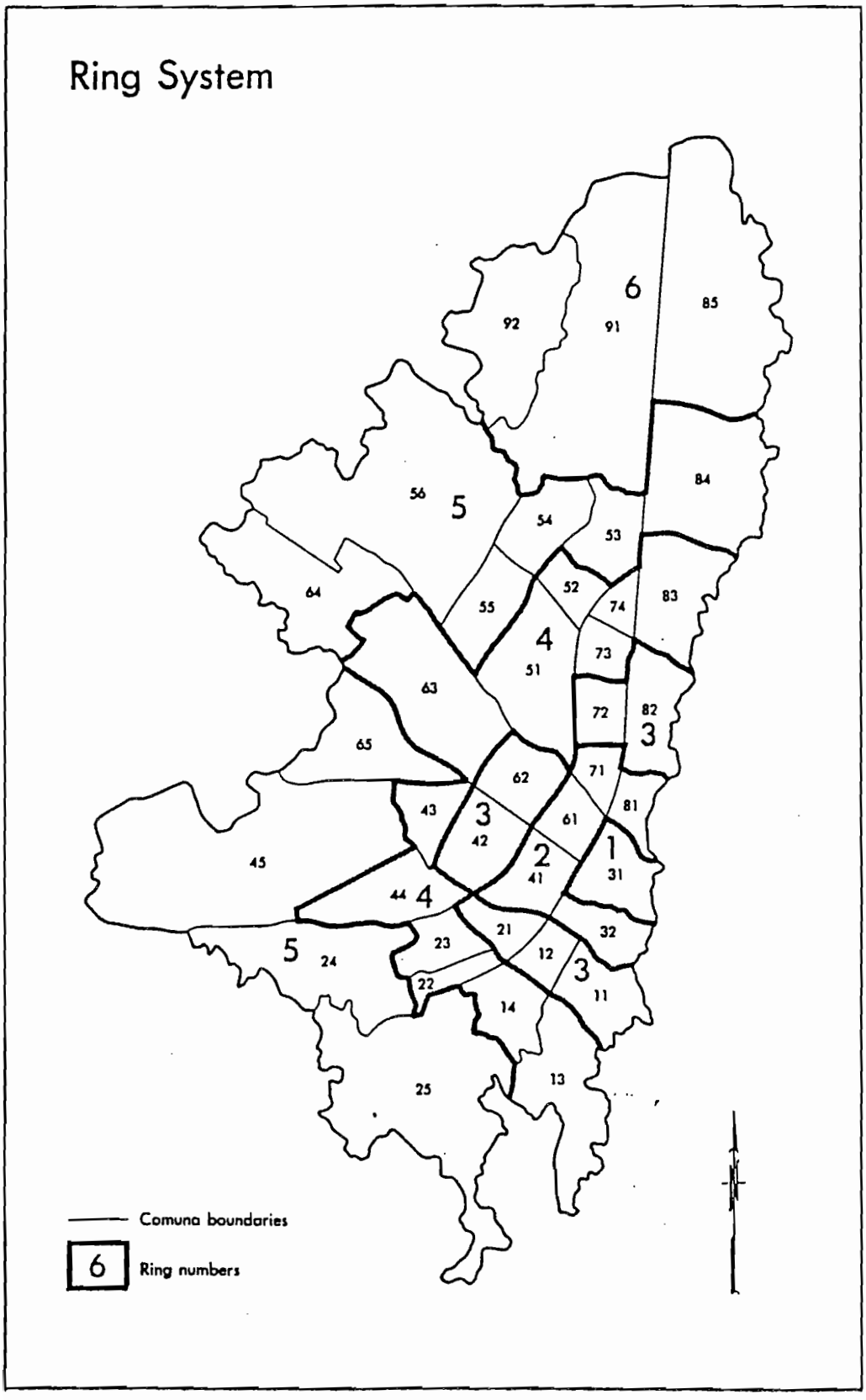
Table 13

The Spatial Pattern of Housing in Bogotá, 1978

	Mean Household Income Index	Percent Single-Family	Average Age of Dwelling Unit (years)	Average Number of Floors	Average Space per Person (m^2)
Ring 1	62	39	16	7.1	14
Ring 2	116	57	21	3.5	23
Ring 3	124	74	16	2.8	30
Ring 4	112	86	12	1.7	23
Ring 5	82	95	9	1.8	18
Ring 6	122	100	8	1.5	26
Total	100	85	12	2.1	21
Sector 1	61	39	16	7.1	14
Sector 2	53	96	13	1.4	12
Sector 3	74	91	10	1.8	19
Sector 4	96	91	11	1.9	25
Sector 5	103	72	18	3.4	20
Sector 6	97	92	10	2.1	21
Sector 7	122	84	17	1.9	30
Sector 8	236	59	10	2.9	45
Total	100	85	12	2.1	21

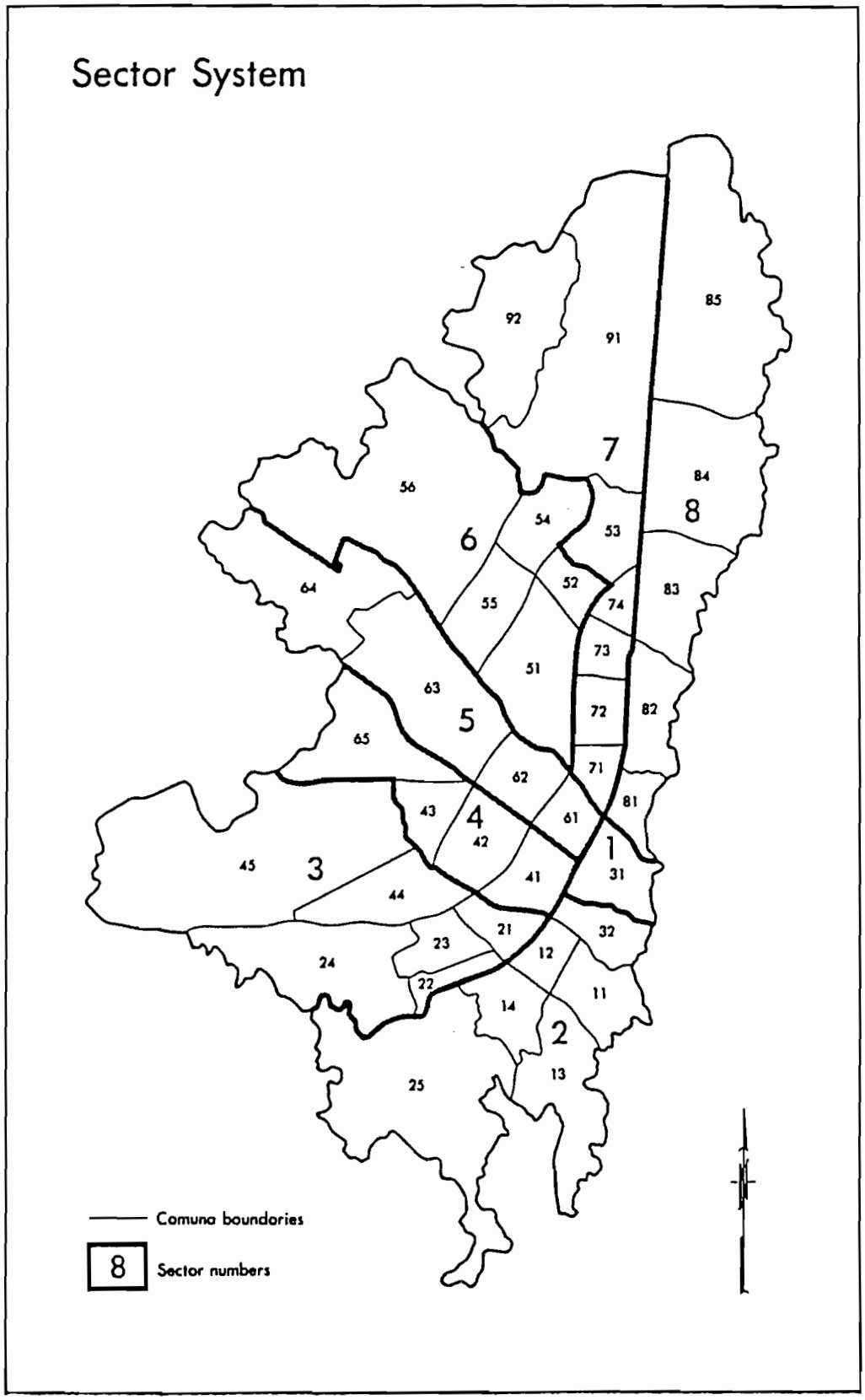
SOURCE: Mohan and Villamizar, 1982.

Map 7.



Source: Mohan and Villomizar, 1982.

Map 8.



Source: Mohan and Villomizar, 1982.

common belief (admittedly true in many cases) that the poor in Latin American cities live at the periphery, and the rich in the center.

As we move away from the CBD, single-family dwellings become more prevalent, but the trend in space per person is not consistent. Once we accept that households do not have identical preferences, and therefore may have quite different marginal rates of substitution between space and accessibility even when incomes are the same, the smooth relationship between space consumed and distance from the CBD is no longer a necessary outcome. More importantly, since employment and commerce are found in many locations outside the center of Bogotá, a model premised on accessibility to downtown becomes inadequate. There are, in fact, reasons to believe that the spatial patterns described in the above data have changed substantially in recent years. New formal-sector subdivisions built on the periphery are increasingly composed of multi-story apartment buildings rather than single-family (row) houses. We might hypothesize that densities in the Colombian capital now take on a U shape: decreasing and then increasing as we move away from the CBD. The exception would be to the south, where a blanket of low-rise, high density, informal-sector housing is continually expanding.

Mohan and Villamizar conclude their data analysis with a look at the evolution of land prices along main radial corridors in Bogotá. Their graphs show real declines over time in the CBD, and a general tendency toward real increases farther out. Figures presented later in this paper illustrate more clearly what has happened to land prices in the main north-south corridor overtime.

In another paper (1982), Villamizar provides extensive information on the evolution of land prices in Bogotá at the city level, by ring, and by radial sector. Data are presented both for individual years and for groups of years, the latter using moving weighted averages. Price gradients are estimated for each of the years 1955-1978. Finally, Villamizar repeats the corridor analysis of the paper written with Mohan.

Villamizar finds that, during the period under study (1955-1978), real land prices in Bogotá have increased around 4 percent per year. During this entire period, the pattern of average land values declining with distance from the CBD is maintained. However, while at the city level prices increase, the CBD experiences an annual drop in real land values of 2.5 percent, and the next ring a drop of 1.1 percent. Succeeding rings experience progressively greater annual increases in value. When radial sectors (pie-shaped wedges) are drawn

out from the CBD, the poorer wedges or sectors tend to have higher rates of land value increase than more affluent zones.

Villamizar concludes his work by stating:

> At the aggregate level Bogotá remains a monocentric city according to the evidence of land price levels, although it is evolving into a multicenter city... The highest values of prices in corridors, however, do not necessarily coincide with the CBD. These higher points or peaks remain "hidden" when a more aggregate analysis is used. (p. 287)

Mohan and Villamizar have done a useful analysis of the Bogotá data, but the serious shortcoming of their work is that it is done using a monocentric paradigm which they themselves recognize is not the most appropriate model. Later in this paper, we will look more closely at the phenomenon of multinucleation.

A New Look at Mohan and Villamizar's Data

In this section, we extend the analysis of Mohan and Villamizar, by both disaggregating and regrouping the data. This data manipulation improves our understanding of the spatial and temporal dynamics of land prices in Bogotá. In particular, it shows that, while conclusions as to overall trends may be fairly robust, more specific findings are quite sensitive to the precise level of aggregation and disaggregation used. Later in the paper we will use Mohan and Villamizar's data to make some preliminary observations on the emergence of subcenters in Bogotá.

Disaggregation by Year and Comuna

Villamizar calculated percentage changes in land values using moving averages. One justification for this "smoothing" process is that when data for a particular year and comuna are sparse, the calculated average land price may be quite unrepresentative of overall market conditions. On the other hand, however, the year-to-year trends in land values often are quite erratic, whether due to waves of speculation, general economic conditions, or the workings of credit markets.

Comparing rates of population growth with the movements in land prices over the same period may give us at least a partial idea as to the role of demo-

graphic pressures in shaping the demand for land and housing. Table 14 shows the trends in population and land prices at the comuna level for the periods 1964-1973 and 1973-1977. Numbers for 1964 and 1973 are from the Colombian census, while 1977 population figures are World Bank/DANE estimates. In all cases, the comuna-level population figures are estimates made from citywide totals (Mohan [1980, 1986] for a description of the methodology used). The Colombian census does not report Bogotá's population at a more disaggregated level.

While there was a positive correlation between changes in population and changes in land prices at the comuna level, the relationship was not as strong statistically as we might have expected. The correlation coefficients calculated were .18 for 1964-1973, and .38 for 1973-1977. On the other hand, however, a closer examination of comuna-level population trends as calculated by Mohan suggests that some of the numbers may be off by a significant amount.

Land Price Changes at the City Level

For his sole-authorship paper, Villamizar calculated an annual index of overall land values in Bogotá, with 1955, the base year, equal to 100. Villamizar computed the numbers for the index by taking the average land values (in nominal terms) at the comuna level, and then weighting them by the land area of the comuna. The index in real terms was calculated using the Consumer Price Index as a deflator. As a result of this procedure, Villamizar concluded that overall land prices had risen 18 percent annually in nominal terms, and 4 percent annually in real terms.

Villamizar's technique is quite reasonable, as it gives each district of the city a weighting in the computation of the overall price average equal to its relative land area. We know that the observations included in the World Bank data set were not chosen for spatial balance, but rather reflect that reliable data are more available in some zones than in others. On the other hand, however, a simple average of the land prices contained in the data set may better reflect the actual conditions in the land market, where particular areas of the city experience more transactions at a given point in time. When we calculate simple (unweighted) averages of land prices in Bogotá, we find that the increases are less than under Villamizar's spatial weighting (Table 15). Instead of nominal land prices rising at 18 percent annually from 1955 to 1978, the increase is only 11 percent. In real terms there is actually an

Table 14

Trends in Population and Land Prices at the comuna Level, Bogotá, 1964-1977

Comuna	Distance From CBD (km)	Land Area (ha)	Percent Annual Change in 1964-1973 Population	1964-1973 Nominal Land Prices	1964-1973 Real Land Prices	1973-1977 Population	1973-1977 Nominal Land Prices	1973-1977 Real Land Prices
11	3	431	3	29	17	8	15	-4
12	3	223	7	12	1	11	19	-2
13	6	836	11	-	-	8	-	-
14	5	383	3	11	-	10	18	-3
21	4	251	1	8	-2	5	38	14
22	5	169	0	11	-1	8	26	4
23	5	280	3	23	11	1	-6	-23
24	9	1,174	11	14	3	-4	22	1
25	8	2,190	12	18	6	1	-	-
31	1	398	-1	6	-4	-2	14	-7
32	2	294	-3	0	-10	12	24	2
41	2	381	3	13	2	-4	4	-15
42	4	485	13	16	4	4	6	-12
43	6	281	9	10	-1	-3	22	0
44	7	588	13	14	3	8	17	-4
45	10	2,851	16	19	8	8	17	-4
51	6	881	8	10	-1	13	15	-5
52	8	209	3	10	1	0	17	-7
53	9	439	10	13	2	10	26	3
54	10	442	12	-	-	0	13	-7
55	8	462	6	10	-1	-7	23	1
56	12	3,679	25	-	-	15	25	2
61	2	278	-2	5	-5	-10	22	0
62	4	417	0	10	-1	14	23	2
63	8	1,224	8	13	2	11	25	2
64	12	1,147	20	15	4	0	21	-1
65	7	767	16	9	-2	9	23	1
71	3	189	3	10	-1	2	19	-1
72	5	270	0	10	-1	9	28	5
73	6	265	2	18	6	3	-1	-18
74	8	174	6	12	1	-10	9	-12
81	2	215	-2	-	-	-6	-	-
82	5	498	2	10	-1	-4	26	3
83	8	670	5	12	1	10	32	8
84	12	1,178	62	11	0	19	43	17
85	16	2,076	-	21	8	10	37	13
91	15	2,518	24	18	6	21	17	-4
92	15	1,209	-	-	-	19	-	-

SOURCES: Mohan, 1980; Mohan, 1986; Authors' calculations from World Bank Bogotá land price data.

Table 15

Unweighted Average Land Prices at the City Level,
Bogotá, 1955-1978,
Calculated from World Bank Data Set

Year	Nominal Price (pesos/sq. meter)	Percent Change	Real Price (pesos/sq. meter)	Percent Change
1955	118		116	
1956	119	-.8	111	-4.3
1957	152	27.7	126	13.5
1958	164	7.9	118	-6.3
1959	164	0.0	110	-6.8
1960	160	-2.4	103	-6.4
1961	186	16.3	111	7.8
1962	205	10.2	116	4.5
1963	241	18.0	108	-6.9
1964	294	22.0	117	8.3
1965	245	-16.7	91	-22.2
1966	251	2.4	79	-13.2
1967	332	32.3	95	20.3
1968	467	40.7	126	32.6
1969	403	-13.7		-21.4
1970	357	11.4	83	-16.2
1971	445	24.6	94	13.3
1972	393	-11.7	74	-21.3
1973	573	45.8	89	20.3
1974	717	25.1	95	6.7
1975	673	-6.1	71	-25.3
1976	888	31.9	79	11.3
1977	119	26.0	79	0.0
1978	1,393	24.6	83	5.1

	Nominal	Real
1955-78 total change in average land prices	1,181%	-28%
Villamizar's results	4,525%	272%
1955-78 annual change in average land prices	11.1%	-1.4%
Villamizar's results	18.0%	4.4%

SOURCES: Villamizar, 1982; Authors' calculations from World Bank Bogotá land price data.

annual decline of 2 percent, instead of a 4 percent increase. Again, no claim is made that our formulation is the correct one, and Villamizar's incorrect. Rather, the results of the two techniques show the sensitivity of the data to different forms of aggregation. One reason that Villamizar's aggregation technique gives higher increases in land prices is that comunas at the periphery, which have higher rates of increase, tend to be larger in area.

FEDELONJAS

FEDELONJAS, the Colombian Federation of Real Estate Boards, maintains an ongoing research effort to track land prices in the country's major cities. Much of this information at a disaggregated level is reserved for affiliated realtors, but summaries of the findings have been published in two reports (FEDELONJAS, 1984; 1988), and in newspaper articles ("En auge mercado de oficinas...," 1988; "Empieza el ciclo de descenso," 1988). The 1984 document was in turn an update of a previous study done by the builders' association CENAC (Borrero and Gámez, 1980). The Borrero and Gámez study of land prices in Bogotá was perhaps the first to make a decisive break with the monocentric paradigm. The authors emphasized what they called the "pluricentric" nature of the Colombian capital. They concluded that over the 20-year period 1959-1978, the price of land in Bogotá had kept ahead of the inflation rate, but that this was the net result of consistently high price increases in the 1960s, followed by more erratic behavior in the 1970s. In the view of Borrero and Gámez, the upward price movement of the 1960s was fuelled primarily by the city's high population growth, while in the 1970s the driving forces behind rising land prices were the stimulus given to construction by the introduction of UPAC financing (1973-1974) and a general economic boom propelled by skyrocketing world coffee prices (1977-1979). The periods 1971-1972 and 1975-1976 saw a fall in real land prices in Bogotá, due in the first instance to a scarcity of construction financing, and in the second case to an economic recession.

The 1984 FEDELONJAS report covered trends in the largest cities of Colombia. It was a preliminary research report whose publication was prompted by concerns over the turbulent state of the national real estate market:

> A period of devaluation was hypothesized for the 1980s, and for this reason FEDELONJAS felt it important to investigate the magnitude of the fall in prices: how long, in which cities,

> and for which land uses. The answers to these questions will permit the real estate sector to make adequate projections, to make plans and strategies according to the actual situation, and not based on false hopes. (FEDELONJAS, 1984, p. 1, present authors' translation)

In September 1988 FEDELONJAS, together with two other organizations of real estate professionals, published the most exhaustive study of land prices in Bogotá done to date. This report updates the Borrero and Gámez and earlier FEDELONJAS work. It utilizes both the original CENAC data (for the years 1959-1978), and approximately 15,000 additional observations (for the years 1979-1988). These recent data come primarily from land value assessments made by realtors, not actual transactions. However, because of the large number of observations, and the fact that they come from 41 different realty firms, we have considerable confidence in the reliability of the data. The assessments by realtors are different from cadastral assessments, and are supposed to approximate the true market value of the property.

There are three key features of the 1988 FEDELONJAS study: time-series profiles of nominal and real land prices in 50 representative areas of the city, calculation of annual percentage price changes in each of these areas, and maps of land value contours at the city level for the years 1979-1987. While the conceptual framework for the analysis of land prices is ostensibly derived from the work of French scholars such as Mayer (1965) and Granelle (1970, 1975), in essence the study uses the familiar model of values dependent on accessibility. The authors also emphasize the role that neighborhood life-cycles within broader macroeconomic cycles play in influencing land price trends. When an area is initially developed, land prices are subject to large annual percentage increases. Once the same area becomes settled, the upward movement in land values is slowed considerably. Eventually the structural obsolescence of the building stock in a mature neighborhood may lead to a significant decline in real property values. One of the authors of the FEDELONJAS report referred to this phenomenon as the "American model" in a conversation with one of the authors of this paper writer (Borrero, 1989). What he meant by this remark is that in the absence of major urban renewal efforts by the government, developers have preferred to work with tracts of vacant land, rather than redevelop already-urbanized areas.

The authors of the new FEDELONJAS study have identified one-and-one-half macroeconomic cycles in Colombia during the period 1979-1988: a boom (1977-

1981) and bust (1982-1985) cycle, and then a subsequent recovery which was still taking place in 1988. The two boom periods were assisted by strong export earnings and general economic growth, and in the building sector by ample credit availability. The building recession of 1982-1985 was a manifestation of a generalized economic crisis, as well as credit restrictions on housing for the upper end of the market.

The overall picture presented by the FEDELONJAS studies is one of "boom-bust" cycles imbedded within an overall secular increase in real land prices. The authors estimate that real land prices in Bogotá increased approximately six times between 1959 and 1988, which would imply an annual rate of approximately 6.4 percent. This paper emphasizes the fact that the choice of weighting scheme for calculating an overall land price and rate of change greatly influences the final results. Mohan and Villamizar's data from 1955 to 1978 showed a 4.4 percent annual increase, or 1.4 percent annual decrease in real land values, depending on how the average was calculated. In light of these results, the 6.4 percent annual increase from the FEDELONJAS study seems somewhat high. Clearly, however, land in developing areas has tended to increase in value at a rapid rate, even as "obsolete" areas have suffered from stagnant, and even declining, real prices. The body of the FEDELONJAS report contains data on real changes in average land prices for representative areas of the city between 1978 and 1988, and this information is summarized in Table 16. Perhaps the most striking thing to notice about these numbers is that, apparently, the 1980s were a decade of declining real prices for commercial land, and rising real prices for residential land. Only nine out of 21 commercial areas had higher real land values in 1988 than in 1980, whereas 22 ouf of 27 mostly residential zones experienced increases. Of the five residential areas listed in Table 16 as having falling real land values, four are consolidated middle- or upper-middle-class neighborhoods (Modelia-Normandía, Esmerelda-Pablo N, Nicolás de Federman-Nuevo Campín, and Las Villas. Of the four, Las Villas has the newest housing stock.

Only in Modelia-Normandía and Esmerelda-PabloN did the average annual decline in land prices exceed one percent. The difficulty of assembling large land tracts in already-developed areas, and the nature of the existing housing stock, may be depressing the land prices. The housing in these areas is not su much structurally obsolete, as it is less attractive and secure than new middle-class subdivisions.

Table 16

Summary of FEDELONJAS Data: Land Prices in Pesos per Square Meter for Selected Localities in Bogotáa

Area	1978 Nominal Price	1978 Real Price (1987 pesos)	1983 Nominal Price	1983 Real Price (1987 pesos	1988 Nominal Price	1988 Real Price (1987 pesos)	Annual Real Rate of Change, 1978-1988 (percent)
CENTER:							
Calles 13-15, Carreras 6-8	18,880	133,239	42,139	102,304	45,000	37,704	-11.9
Calles 11-12, Carreras 9-13	12,000	85,046	20,000	48,555	35,000	29,326	-10.1
Calle 19, Carreras 9-11	8,800	62,367	33,059	80,260	44,000	36,866	-5.1
Carrera 7, Calles 20-24	15,000	106,308	28,000	67,978	45,000	37,704	-9.8
Calles 4-7, Carreras 4-7 (historic preservation area)	1,893	13,416	12,000	29,133	22,000	18,433	3.2
INTERNATIONAL CENTER:							
International Center I: Calles 25-33, Carreras 7-13	26,000	184,000	50,000	121,389	74,000	62,002	-10.3
International Center II: Calles 34-39, Carreras 7-13	12,800	90,715	36,094	87,628	55,000	46,083	-6.5
OTHER MIDDLE- AND UPPER-INCOME COMMERCIAL AREAS:							
Chapinero, Calles 57-63, Carrera 13	25,787	182,757	60,000	145,666	80,000	67,030	-9.5
Calles 51-54, Carreras 23-30	6,800	48,193	20,000	48,555	45,000	37,704	-2.4
Calle 72, Carreras 7-11	10,000	70,872	48,159	116,919	90,000	75,408	.6

Table 16 (continued)

Area	1978 Nominal Price	1978 Real Price (1987 pesos)	1983 Nominal Price	1983 Real Price (1987 pesos	1988 Nominal Price	1988 Real Price (1987 pesos)	Annual Real Rate of Change, 1978-1988 (percent)
Carrera 15, Calles 72-76	10,570	74,911	30,000	72,833	67,188	56,295	-2.8
Carrera 15, Calles 83-88	18,938	134,217	45,000	109,250	75,000	62,840	-7.3
Carrera 15, Calles 90-94	10,500	74,415	45,000	109,250	75,000	62,840	-1.7
Carrera 15, Calles 95-100	8,800	62,367	51,000	123,817	85,000	71,219	1.3
Calle 100, Carreras 7-15	10,471	74,205 (1980)	37,891	92,000	119,982	100,545	3.1
Carrera 15, Calles 115-127	5,000	35,436	40,000	97,111	90,000	75,408	7.8
LOW-INCOME COMMERCIAL AREAS:							
Siete de Agosto: Calles 65-69, Carreras 23-25	6,800	48,193	20,000	48,555	60,000	50,272	.4
Las Ferias: Calle 68, Avenida 68 to Avenida Boyacá	4,130	29,270	16,990	41,248	55,000	46,083	4.6
Ricaurte: Carreras 27-28, Calles 10-13	4,500	31,892	22,443	54,487	45,000	47,704	1.7
Restrepo: Carreras 17-21, Calles 13 sur-22 sur	8,936	63,331	22,831	55,429	52,500	52,367	-1.9
Venecia: Diagonales 44 sur-31 sur, Carreras 51-52	7,652 (1980)	34,268 (1980)	14,978	36,363	55,000	46,083	3.8 (1980-1988)

Table 16 (continued)

Area	1978 Nominal Price	1978 Real Price (1987 pesos)	1983 Nominal Price	1983 Real Price (1987 pesos	1988 Nominal Price	1988 Real Price (1987 pesos)	Annual Real Rate of Change, 1978-1988 (percent)
HIGH-INCOME RESIDENTIAL:							
Rosales: Calles 72-85, Carrera 5 to the east	3,892	27,583	17,750	43,093	80,000	67,030	9.3
Regugio: Calles 85-88, Carrera 7 to the east	5,076	35,975	18,813	45,673	70,000	58,651	5.0
La Cabrera: Calles 85-88, Carreras 7-15	3,712	26,308	19,711	47,854	110,000	92,155	13.4
Santa Bibiana-Navarra, San Patricio-Santa Barbara Occ.: Calles 100-127, Carreras 15-19	3,400	24,096	11,963	29,043	40,000	35,515	4.0
Multi-centro-Carolina, Calles 114-129, Carreras 11-15	3,752	26,591	14,825	35,992	80,000	67,030	9.7
UPPER-MIDDLE-INCOME RESIDENTIAL:							
Puento Largo-Pasadena: Calles 101-107, Carreras 24-44	2,500	17,717	8,093	19,648	30,000	25,136	3.6
Alhambra: Calles 109-117, Transversales 25-48	3,000	21,262	11,000	26,705	40,000	33,515	4.7
Niza Sur: Calles 118-125A, Carreras 52-57	2,425	17,188	7,556	18,345	23,438	19,638	1.3
Niza Norte: Calles 126-129, Carreras 52-59	2,780	19,710	8,734	21,205	30,000	25,136	2.5
Las Villas: Calles 126-129, Carreras 48-52	2,323	16,501	7,200	27,480	18,000	15,082	-.9

Table 16 (continued)

Area	1978 Nominal Price	1978 Real Price (1987 pesos)	1983 Nominal Price	1983 Real Price (1987 pesos	1988 Nominal Price	1988 Real Price (1987 pesos)	Annual Real Rate of Change, 1978-1988 (percent)
Nueva Autopista: Calles 134-146, Transversal 30-Autopiste del Norte	2,786	19,742	8,143	19,770	35,000	29,324	4.0
MIDDLE-INCOME RESIDENTIAL:							
Modelia-Normandía: Calles 31-45, Carreras 72-85; Calles 47-56A, Carreras 66-77A	2,645	18,743	8,409	20,415	18,700	15,668	-1.8
Esmeralda-Pablo VI: Calles 40-63, Carreras 39-48	2,278	16,142	8,257	20,046	15,625	13,092	-2.1
Nicolás de Federman, Nuevo Campín: Calles 53-63, Carreras 33-39	2,551	18,079	10,365	25,163	20,000	16,757	-.8
Cedritos: Calles 140-147, Carrera 7-Transversal 30	2,500	17,718	6,955	16,885	31,250	26,183	4.0
Campiña-Campanella: Calles 142-146, Carreras 92-99	981	6,953	4,822	11,707	15,000	12,568	6.1
LOWER-MIDDLE-CLASS RESIDENTIAL:							
Madelena-Villa del Río: Calles 57-65 sur, Carreras 64-67; Calles 55-57 sur, Carreras 65-71	1,091	7,732	5,435	13,195	12,500	10,472	3.1
Fontibón: Calles 15-40, Carreras 92-130	1,771	12,522	3,778	9,172	12,500	10,473	-1.8
Minuto-España Quirigua-Bolivia: Calles 81-82, Carreras 72-96; Calles 78-90, Carreras 104-110	1,500	10,631	6,158	14,950	14,051	11,782	1.0

Table 16 (continued)

Area	1978 Nominal Price	1978 Real Price (1987 pesos)	1983 Nominal Price	1983 Real Price (1987 pesos	1988 Nominal Price	1988 Real Price (1987 pesos)	Annual Real Rate of Change, 1978-1988 (percent)
El Cortijo: Calles 78-90, Carreras 120-130	760	5,386	2,930	7,114	10,000	8,379	4.5
Rincón-Tibabuyes: Calles 120-142, Carreras 91-130	715	5,068	4,360	10,586	12,500	10,473	7.5
LOW-INCOME RESIDENTIAL:							
Southeast I: Calles 20-31 sur, Carrera 16 to the east	1,151	8,157	3,972	9,643	12,000	10,054	2.1
Southeast II: Calles 32-51 sur, Carrera 19 to the east	755	5,348	3,581	8,695	10,500	8,798	5.1
Suroriente III: Calles 51-99 Sur, Carrera 6 to the east	600	4,252	3,000	7,283	10,500	8,798	7.5
Bosa	600	4,252	3,186	7,736	10,000	8,379	7.0
Patio Bonito-Britalia-Class: Calles 14-60-sur, Carreras 86-120	-	-	3,268	7,933	10,000	8,379	1.1 (1980-1988)
Toberín-Estrella Norte-Britalia Norte: Calles 161-170, Carreras 32-54	750	5,315	3,246	7,880	13,500	11,311	7.8
CONSOLIDATED (ESTABLISHED) INDUSTRIAL ZONE:							
Carreras 30-68D, Calles 6-23	3,009	21,323	8,477	20,580	25,000	20,947	-.2
DEVELOPING INDUSTRIAL ZONE:							
Montevideo: Carreras 680-92, Calles 13-24	1,367	9,690	5,746	13,950	35,000	29,326	11.7

SOURCE: FEDELONJAS, 1988

When the residential areas of Bogotá studied by FEDELONJAS are grouped according to both income level and stage of development, the trends discussed above become more clear. Table 17 reproduces summary data contained in the FEDELONJAS report. As can be seen from this table, with all income classes it is the case that neighborhoods still being developed have experienced considerably greater increases in real land prices than consolidated areas. Taken as a whole, middle-middle and lower-middle-class consolidated neighborhoods have actually undergone declines in real land values. Determining land prices in a developed area is always a difficult proposition. On the one hand, the few vacant parcels of land which are for sale may be inferior properties that were passed over when the neighborhood was being built up. On the other hand, if an already built-up area is considered especially attractive, it may be possible for land sellers to extract monopoly rents that result in prices not being truly indicative of the opportunity cost of the land. A calculation of land price changes in a developed area may be based either on a few such problematic transactions, or on highly subjective assessments. While we feel that the FEDELONJAS data from mature neighborhoods may be somewhat less reliable than those from developing areas, it is undoubtedly true that prices in consolidated zones are increasing less slowly than in newer areas, and may in some cases be falling in real terms. The areas chosen for the FEDELONJAS study to represent "middle-middle" class residential zones, Modelia-Normandía, Esmeralda-Pablo VI, and Nicolás de Federman are all in the center-west portion of Bogotá, and, at least through the 1970s, could have been considered within or close to the upper-middle-income classification. These neighborhoods contain dwellings which are structurally sound and of relatively modern vintage. Some of the single-family units (row houses) are perhaps excessively large by current standards, but there are many moderate-sized dwellings as well. The most serious problems facing these areas are two forces which are afflicting other mature neighborhoods of Bogotá: the difficulty in obtaining financing for used dwellings, and the real or perceived security problems in housing developments which are not "conjuntos cerrados" (closed compounds). An examination of real estate advertisements in the Bogotá newspaper El Tiempo in mid-1989 revealed a large number of houses available in the Esmeralda neighborhood, which has a reputation as an area with a high incidence of robbery. This writer also observed efforts to close off streets to through traffic in the Modelia neighborhood, and to install gates and guardhouses.

Table 17

Percent Changes in the Real Price of Land
for Residential Use, by Income and Type of Housing,
Bogotá, 1980-1988

	Annual Percentage Real Price Change, 1980-1988
Upper Income	
All (both consolidated and under development)	4.2
Upper-Middle Income	
Consolidated*	.2
Under development	2.8
Middle-Income	
Consolidated	-5.7
Under development	1.8
Lower-Middle Income	
Consolidated	-.5
Under development	2.5
Low Income	
Consolidated or in transition	3.9
Under development	6.2

*The official term is "conservación y rehabilitación," referring to two kinds of established neighborhoods: those which for architectural, historic, or environmental reasons are to be preserved without substantial physical modifications, and those which can undergo transformations in response to the pressures of the market.

In general, the upward pressure on land prices during the 1980s has been strongest in zones occupied by households at the two extremes of the income spectrum. This is an intuitive result, the outcome of both supply and demand factors. We expect that more affluent households will have a lower price elasticity of demand for housing services than the middle class, due to a greater discretionary income. At the same time, however, the process of land-capital substitution has probably been most pronounced in the richest neighborhoods (i.e., the response to rising land prices has been more elastic). We argue that the logic behind this process is as follows. Middle- and upper-income households in Bogotá care relatively little about the consumption of land per se, and are more concerned about the amenities and personal safety offered by their housing unit and neighborhood. Since only a few areas of Bogotá have the amenities (real or imagined) to qualify as suitable locations for the city's richest households, these zones can command significant scarcity rents. The high land prices lead builders to construct taller structures (when permitted by zoning regulations) and smaller housing units, at a steep per-square meter cost. The low elasticity of demand for housing services is accompanied by densification, an increase in the amount of built space per unit of land. It is important to make a distinction between higher densities and an increase in capital intensity. While having taller structures or a greater floor/area ratio almost always does imply greater capital intensity, the capital/land ratio can also be increased through changes in building quality.

The poorer areas highlighted in the FEDELONJAS report all experienced substantial increases in real land prices from 1980 to 1988. In light of evidence developed especially by Molina (1989), it appears that the high prices have been the result of both persistent demand pressure and monopoly rents appropriated by land sellers. Intuitively we expect the poor to have a high price elasticity of demand for housing services. However, housing for very-low-income groups usually consists of detached houses, row houses, or apartment buildings of three stories or less. The potential for obtaining a greater amount of built space per unit of land within one of these forms of production is not great; land is already being used at a minimum. The shift from self-built detached houses to taller formal-sector dwellings can save on land, although, as this paper points out, densities in "pirate" and directed self-help subdivisions are already very high. The problem, however, is that land savings must be balanced off against a higher construction cost (more capital)

per square meter of built space. If the demand curve for housing services is downward-sloping, and the elasticity of substitution between land and capital in housing production is less than unity, an increase in the price of land leads households to consume both less land and less capital. The reduction in capital can take the form of a decrease in the quality of construction and/or a fall in living space. The reduction in land consumption of implies a higher density. However, instead of moving along the density continuum of detached house/row house/apartment, lower-income households in Bogotá have generally cut back on both land and space consumption within a particular housing type. The reason is that switching housing types involves more than just changing capital/land ratios to obtain a homogeneous good "space". In the context of Bogotá, a low-income household that moves from a detached house (usually self-built) to a formal sector row house will experience a considerable increase in per-square meter shelter costs. The same may be true, though to a lesser extent, of a move from row houses to apartments. Our contention is that the cost "discontinuities" are so great that low-income households cannot make the transition across housing types. The poor of Bogotá make up around half of the city's households. Rather than consider them as a homogeneous group, it is more appropriate to classify them into a series of income subgroups, each one of which will tend to be matched with a particular type of housing.

Our argument is that the poor have a high price elasticity of demand for land, and have adapted to higher prices by sharply reducing their consumption of this input. Molina presents data from District Planning which show the dramatic decline in lot sizes. During the period 1974-1979, gross lot size in new "irregular" (i.e., illegal) subdivisions was around 235 square meters. By the mid-1980s the figure had dropped to around 150 square meters. The net area of these lots, i.e., the area which could be built on, was typically only around 75 square meters. Thus, by 1985, new pirate subdivisions had lot sizes very similar to the 72 square meters promoted as the standard in minimum-norm subdivisions. The government's "minimum housing solutions" typically ranged in size from 26 to 46 square meters, below the average from a 1978 survey of 72 square meters for housing units in pirate subdivisions (Hamer 1985).

The dynamics of commercial land markets in Bogotá are perhaps even more striking than those of residential areas. There has been a major spatial transformation of the office market in the Colombian capital. According to FEDELONJAS, whereas, in 1977, 67 percent of the new office space in Bogotá was

being constructed in the center of the city and only 4 percent north of the Avenida de Chile (Calle 72), in 1988 only 2.5 percent was being constructed downtown, and 75 percent in the north ("En auge mercado...," 1988). The realtors calculate that land values at a key downtown location, Avenida Jimenez (Calle 13) and Carrera 7, are in real terms at only one-sixth the level of twenty years ago. In terms of its land values, the traditional downtown has slipped to sixth place among the key office and retail areas of the city. In fact, if the FEDELONJAS study is to be believed, land prices in the top six subcenters increase steadily as one moves away from downtown ("Empieza el ciclo de descenso," 1988).

High land prices are often an object of concern, especially as they have an impact on the cost of housing. In the case of Bogotá's downtown, however, the low land prices are seen as an alarming indicator of decline. Even though there are ample profit-making opportunities in other parts of the city, there is also a wide range of investors and employers with a vested interest in maintaining a strong downtown. Unlike in many other cities of the world, however, in Bogotá there has been no coalition strong enough to push for the institutional changes that would be necessary for the CBD to reassert itself as a center of employment, commerce, and public life. Downtown Bogotá is in no danger of being abandoned, but in its new role it will be only one of three major administrative centers (the others being the Centro Administrativo Distrital [CAD] and the Centro Administrativo Nacional [CAN], both shown on Map 3), and its role as a retail center for middle and upper-middle households will be minor. If the experiences of other countries are any indication, downtown Bogotá and the adjacent Centro Internacional will most likely continue to serve as the city's (and Colombia's) main financial services center.

1989 Land Prices

As the FEDELONJAS study is based primarily on realtor assessments, and contains data only until mid-1988, we have compared a few of its reported 1988 land prices with 1989 prices from classified newspaper advertisements (a form of "potential" transaction). A few of these comparisons are listed in Table 18. Given the highly location-specific nature of land values, the degree of correspondence between values from the two sources is encouraging. The prices quoted in the newspaper advertisements were discounted 20 percent. This

Table 18

Comparison of Land Prices,
FEDELONJAS Study and Newspaper Advertisements

Location advertised in El Tiempo, and advertised price, mid-1989	El Tiempo price discounted 20% to account for inflation	FEDELONJAS location and 1988 price, in pesos/M^2
LOW-INCOME RESIDENTIAL:		
Altamira subdivision, $7,500	$6,000	Suroriente (Southeast) II, $10,500
Diana Turbay subdivision, $16,667	$13,334	Suroriente (Southeast) II, $10,500
Ciudad Bolivar, lots with services, $7,299	$5,839	Patio Bonito, $8,000
COMMERCIAL:		
Centro Internacional, $50,633	$40,506	Centro Internacional, $60,000
Chapinero, Avenida Chile, $113,333	$90,666	Chapinero, $80,000
MIDDLE- AND UPPER-INCOME RESIDENTIAL/MIXED-USE:		
Nicolás de Federman, $57,870	$46,296	Nicolás de Federman, $20,000
Santa Bárbara, $128,610	$102,888	Santa Bárbara Occidental (residential only), $110,000
Calleja, $114,320	$91,456	Unicentro, $90,000; Multicentro, Carolina, $80,000

adjustment is made primarily to take account of inflation, but also to compensate for the fact that advertised prices are subject to negotiation.

On the basis of the FEDELONJAS study and newspaper advertisements, we would say that serviced lots in the low-income subdivisions of southern Bogotá have been selling for a price of between 5,000 and 14,000 1988 pesos per square meter. The wideness of this range reflects differences in accessibility and amenities. For example, Diana Turbay is on flatter, lower land than Altamira, is closer to downtown, and is adjacent to a major road with frequent bus service. In addition, the lot in Diana Turbay was on a corner, which makes it ideal for commercial use.

Molina (1989) found that unserviced lots in Bogotá's periphery were selling for as high as 2,500-3,000 pesos per square meter in 1986, the equivalent of 3,750 to 4,500 1988 pesos. Combining the findings of FEDELONJAS and Molina, we have a price range of from 3,750 to 14,000 pesos per square meter for land in new low-income areas. This translates into 37.5 to 140 million Colombian pesos per hectare. At the official exchange rate of mid-1988 (approximately 300 pesos per dollar), this was equivalent to between $125,000 US and $466,667 per hectare, or approximately $54,450-$203,280 US per acre. This is a very high figure if one considers that this is the cost of land faced by the poorest in a context in which the minimum wage is just under 100 dollars per month.

The International Center (Centro Internacional) and Chapinero are two mature office and commercial areas which have nevertheless continued to undergo some demolition and rebuilding. The FEDELONJAS study put 1988 land prices in these two zones at 60,000 and 80,000 pesos, respectively. Representative 1989 prices from newspaper advertisements included $50,633 for the Centro Internacional, and $113,333 for an expensive part of Chapinero. Another Chapinero lot was advertised at $95,267 per square meter, while a lot on the periphery of the zone, Calle 72 and Carrera 14, was offered for only $50,499 per square meter.

Our comparison of land prices for two middle- and upper-income residential areas reveals a high degree of consistency between data sources in one case, and a surprising discrepancy in the third case. Prices in Nicolás de Federman, a mature middle- to upper-middle-income area, were around 20,000 pesos per square meter in 1988, according to FEDELONJAS. A newspaper advertisement in mid-1989 put the price at almost 58,000 pesos per square meter. It is not clear how to reconcile this large difference, unless the advertised plot

was in an exceptionally choice location. It is our belief that, in this case, the FEDELONJAS study has underestimated true land values.

In the affluent north, the FEDELONJAS prices of 90,000 pesos per square meter around the shopping center Unicentro, and 80,000 pesos in nearby Multicentro and Carolina, are consistent with a typical mid-1989 newspaper advertisement which asks 114,320 pesos per square meter (91,456 pesos in 1988 terms) for a lot in nearby Calleja, and 128,610 pesos for land in Santa Bárbara.

Where and of what magnitude are the highest land prices in Bogotá? The most recent FEDELONJAS map of isoprice contours is for the period 1986-1987. The highest contour listed on it, 100,000 pesos per square meter in 1987 pesos, is found around the Unicentro shopping center and a small number of exclusive, mostly commercial areas between Calle 72 and Calle 100, from Carrera 15 toward the east (i.e., the mountains). The next-highest areas in price, from 80,000 to 100,000 pesos in 1987 terms, were the International Center, a portion of Chapinero, some areas around Unicentro and on main arterials within the affluent north, and some hillside areas in the north which are being used for luxury high-rise apartments. The maximum price for land found in our sample of newspaper advertisements from mid-1989 was in a lot measuring 720 square meters, at Carrera 11A and Calle 89. This is an extremely prestigious location, in the Chicó neighborhood close to many embassies. The lot was zoned for a building height of 19.30 meters (generally five stories), and was being offered for 120 million pesos, 166,667 pesos per square meter. This price is consistent with the 100,000 pesos (in 1987 prices) indicated on the 1986-87 isoprice map. At the August 1989 exchange rate of 400 pesos per dollar, the Chicó lot was valued at $417 US per square meter. This is an impressive amount of money, considering income levels in Colombia.

A Cross-Country Comparison of Land Prices

It is useful to see how land prices in Bogotá compare with those in other cities of the world, and to what extent the cross-city differences are correlated with variations in spatial structure. Table 19 lists for several cities the national (not city) per capita income, a land price (usually at or near the maximum for the city), and a relevant population density. Clearly, land prices in Bogotá do not begin to approach the levels of intensely-developed central business districts in the United States. For example, the most expensive land

Table 19

Incomes, Land Prices, and Densities:
a Cross-Country Comparison

Country	GNP Per Capita, 1987, in US Dollars	City	Land Price per Square Meter in US Dollars	Density (persons per hectare)
Colombia	1,240	Bogotá	$417 (high-income residential and commercial, 1989)	206 (CBD)
United States	18,530	San Francisco	$8,000-$12,000 (downtown,1989)	62 (city)
		Modesto	$9.18-$13.77 (raw land at urban fringe, 1988)	
Thailand	850	Bangkok	$2,300 (most expensive office and commercial area, 1989)	234 (0-5 km from CBD)
Mexico	1,830	Mexico City	$300-$400 (high-income residential and commercial areas, 1989)	113-270 (four central delegaciones)
Pakistan	350	Karachi	$140 (residential land five km. from center)	
Indonesia	490	Jakarta	$106 (residential land five km. from center)	

Sources: Dowall, 1989a, 1989b; International Bank..., 1989; Dowall and Perló, 1987; Mohan and Villamizar, 1982; Kirk, 1988; United States Department of Commerce, 1987; Wilk, 1990; Wilk and Dowall, 1989; Dowall and Leaf, 1990.

in San Francisco's downtown sells for $800-$1200 per square foot, or approximately $8,000-$12,000 per square meter (Dowall, 1989b). Thus, San Francisco's most expensive land is around twenty times the price of Bogotá's. It is reasonable to suppose that simply by virtue of differences in income levels, San Francisco land should be at least ten to fifteen times as expensive as Bogotá land. Much of the remaining difference in prices can be attributed to the spatial nature of San Francisco, a physically attractive city with an intensely developed core and little room for expansion. Bogotá, on the other hand, has fewer controls on land use, and a sprawling and still-expanding main business corridor which extends from downtown to the far north. The United States is generally thought of as a land-abundant country, with much land at the urban fringe acquired by developers at a very low cost. For example, builders have purchased former agricultural land at the edge of Modesto, California, for around $40,000 to $60,000 per acre, the equivalent of $9.18 to $13.77 per square meter (Kirk, 1988). Thus, raw land at the urban fringe in a prosperous sunbelt city compares roughly in price to land in Bogotá's pirate subdivisions. Given this fact, it is not surprising that land in the Colombian capital is used so much more intensely than in most of the United States.

Comparisons of Bogotá's land prices with those of other cities in the developing world are possibly more meaningful. Dowall (1989b) found an average 1986 land price of $116 US per square meter in the most expensive area of Bangkok, Thailand. This was at the same time that, according to FEDELONJAS, land in the affluent north of Bogotá was selling for $500 US per square meter. However, in what is a dramatic manifestation of the current economic boom in Thailand, in 1989 a parcel of land in Bangkok sold for a record $231 per square foot, around $2,300 US per square meter (Dowall, 1989a). On the other hand, however, Bangkok is a city with very pronounced peaks in land value, and prices even in other expensive areas are much lower.

Moving to a Latin American context, as of late 1989 the most expensive land in Mexico City was valued at around $300-$400 US per square meter (Wilk, 1990). Even allowing for the possibility of distortions in exchange rates, the indication is that this is less than the cost of Bogotá's most expensive land. Mexico City is an enormous, polynucleated urban area which continues to expand at the periphery. The extensive rail transit and freeway networks combine with the paucity of tall buildings (due to seismic risks) to create a diffuse,

multi-centered city in which the range of land prices is relatively narrow compared to a traditional monocentric city.

We normally expect a positive correlation between the real burden of land prices on housing producers and consumers, and the density of population. Overall density figures for urban areas in the developing world can be misleading, as the cities usually include large undeveloped tracts of land which will be populated at some time in the future. Thus, figures of 115 persons per hectare in Bogotá (Mohan and Villamizar, 1982), 138 persons per hectare in Mexico City (Wilk and Dowall, 1989), and 22 persons per hectare for the Bangkok metropolitan area (Dowall, 1989a) are neither comparable nor very useful for understanding the link between land prices and intensity of use. Density figures for smaller, already-developed areas provide more insights. Estimates from 1978 give a density of 206 persons per hectare in comuna 31 of Bogotá, a zone which contains the traditional downtown (see Map 6). Comuna 32, a lower-income residential area to the south of downtown, had a density of 343 persons per hectare, while in comuna 83, an affluent northern zone of the city, the estimated density was 136 persons per hectare (Mohan, 1986). Because many single-family dwellings in comuna 83 have been demolished and replaced by apartment buildings in the past decade, the density there is now probably considerably higher. By way of comparison, four central delegaciones of Mexico City had population densities of between 113 and 270 persons per hectare in 1980, and in Bangkok, the area between zero and five kilometers from the CBD had an estimated population density of 234 persons per hectare in 1984 (Dowall and Perló, 1987; Dowall, 1989). Based on the admittedly scanty information presented above, it appears that population densities may be not be higher in Bogotá than in Bangkok. Mexico City's densities do more clearly appear to be lower. If we consider the fact that, in 1987, national per capita incomes were $850 US in Thailand, $1,240 US in Colombia, and $1,830 in Mexico (International Bank..., 1989), we see that the real burden of land prices is considerably greater in both Bangkok and Bogotá than in Mexico City. The fact that land prices in Bogotá are high relative to incomes probably goes a long way toward explaining the intensity with which this input is used. Bogotá is not a high-rise city in the sense of Manhattan or downtown Sao Paulo: there are few residential structures with greater than five stories. However, the transition from houses to apartments among the middle class, and the reduction in the average lot size

in informal settlements, are unmistakable signs of increased densification in the Colombian capital.

At the same time, there are indications that in Bogotá the transition from single-family to multifamily housing involves more than a price-induced input substitution. Households that can afford to buy formal-sector dwellings are strongly attracted to the security provided by an apartment, whether a single building with a doorkeeper, or a closed compound with controlled entry. Closed compounds of row houses can provide the personal safety and collective amenities of apartments, but are limited to a maximum of three stories in height. In many cases, the level of land prices might be such that building three-story row houses would be economically feasible, but at the current standard dwelling size of 60-90 square meters, each floor would be very small. The same consumers who appreciate the privacy of a house also appreciate the spaciousness and absence of stairs in a one-floor apartment.

Land Prices and the Role of Subcenters

It has long been recognized that the monocentric paradigm is an inadequate tool for the analysis of urban spatial structure. In urban areas throughout the world, the dominance of the Central Business District in employment and commerce is being challenged by auxiliary centers of activity. The continued use of monocentric models of urban spatial structure can be best understood as a function of their tractability rather than their realism. In recognition that most urban areas have a more complicated spatial structure, a number of researchers have analyzed the phenomenon of multinucleation. Work in the urban economics tradition has focused on how residences and firms position themselves within a polynucleated city, while regional scientists have explored the conditions under which multiple centers are formed. The literature on subcenters includes Greene (1978), Odland (1978), Ogawa and Fujita (1980), Miron (1978), Lave (1970), von Boventer (1976), Romanos (1975), Solow and Vickery (1971), Papageorgiou (1971), Echenique, et al. (1974), Fales and Moses (1967), McDonald (1987), Richardson (1988), Gordon, Richardson, and Wong (1986), and Heikkila, Richardson, et.al. (1989). The last five articles listed (i.e., Fales and Moses, McDonald, and the three articles with Richardson as a contributor) are the most empirical in their approach.

In reviewing the literature on multinucleation, the most general principle that one finds is that subcenters are an outcome of two opposing sets of forces: those favoring concentration (loosely called "agglomeration economies"), and those favoring dispersion (congestion costs). The article by Greene (1978) provides further discussion on types of subcenters. He presents three scenarios for multinucleation:

1. Firms establish themselves at or outside the urban periphery, in search of lower land and/or transport costs (these firms will tend to be export-oriented). Residential activity is attracted to the area, as workers try to save on commuting costs.

2. Fleeing the high housing costs of already-developed urban areas, workers move to new residential developments at or outside the urban periphery. Shopping centers and even-tually office developments follow.

3. Small urbanized areas are engulfed by larger ones.

The ideas outlined above provide only the beginnings of a theory of subcenters. In spite of the substantial theoretical and empirical work on multinucleation that has been carried out, the declarations of Richardson (1977) still ring largely true:

> In other words, we want a theory of the multi-centric city. Its purpose would be to explain the erosion of the competitive advantages of the CBD and the growth of alternative employment centers (subcenters). In particular, three major questions need an answer. Why do secondary centers develop? Where will they be located? What will be their effects on metropolitan spatial structure? (p. 49)

> An adequate explanation of decentralization trends requires a theory of the multicentric city. The growth of new subcenters distorts the regular rent and density gradients of the standard model. There is no satisfactory theory explaining why these sub-centers develop. (p. 54)

> The monocentric assumptions [of the New Urban Economics models] prevent examination of the evolution of subcenters, **perhaps the most fascinating and the most neglected topic in urban economics** (emphasis added). (p. 91)

All of the scenarios for multinucleation discussed by Greene are found in Bogotá. Industrial firms have moved to the periphery in advance of residents in order to take advantage of lower land costs and easier road access to the

rest of the country. Some shopping centers, particularly the giant Unicentro, have established themselves toward the periphery in order to preempt future competition. The scenario of residential use moving toward the urban fringe and employment following is also very much in evidence in Bogotá. For example, in the area along the Autopista a Medellín (see Map 3), residential growth has outpaced commercial development.

Small urbanized areas which have been absorbed into Bogotá include the former municipalities of Bosa and Usme to the south, Engativá and Fontibón to the west, and Suba and Usaquén to the north. Other nearby towns located outside the urban perimeter of Bogotá have become "subcenters" of the capital in an incomplete sense: they are more bedroom communities than auxiliary centers of residence and employment.

By definition, a subcenter is a zone characterized by greater population densities, employment levels, or commercial activity than surrounding areas. There appear to be no standard criteria for identifying subcenters, although McDonald (1987) has suggested that gross employment density (employment divided by total land area) and the employment/population ratio are the best measures of the spatial concentration of jobs. Residential densities in the employment center itself are likely to be low. However, if land use regulations are not overly restrictive, the desire to live close to work should lead to high densities in adjacent areas, and then a decline over some range of distances. Because accessibility to subcenters has value, their locations should be characterized by local peaks in the land price surface. Clearly then, rent and density gradients, measures of how land values and the intensity of land use vary with distance from a particular point or points, are important tools for analyzing spatial structure in urban areas.

It was Colin Clark (1951) who first suggested that population densities follow the negative exponential form. Working independently from Clark, Muth developed a simplified model of housing markets and population distribution which provided a theoretical justification for the exponential functions. This work was first developed in 1961, but is also contained in a later (1969) book. Muth's model of profit-maximizing housing producers and utility-maximizing housing consumers generates equilibrium results which are satisfied by the function:

$$P(k) = P_o e^{-hk}$$

where P is the price of housing;

P_o is the price at the center;

k is the distance from the center; and

h is a constant which measures the elasticity of the price response.

We expect a positive correlation, but not exact equivalence, between variations in land and housing prices on the one hand, and densities on the other hand. Reasons why land prices and population densities do not follow each other precisely include:

1. Urban areas contain households with a wide range of incomes and relative preferences for space, accessibility, and high-density living.

2. Certain areas of the city, including usually the ones with the highest land values, are taken up by non-residential activity. This depresses population densities in the center, although land use intensities (and therefore prices) are very high.

3. Capital in the form of built structures is not perfectly malleable, and so its use cannot respond immediately to changes in the price of land. On the other hand, in the absence of restrictions on changing land use, there will be long-run adjustments.

The studies produced by Richardson and colleagues provide a point of departure for an empirical analysis of multinucleation in Bogotá. Richardson has been working with a group of researchers who are studying the phenomenon of policentric urban areas, in particular with reference to Los Angeles. One article (Richardson, 1988) lays out the methodological issues surrounding this work, as well as its policy implications. The paper by Gordon, Richardson, and Wong (1986) estimates population and employment density gradients for the Los Angeles area, while Heikkila, Richardson, et.al. (1989) present a hedonic model of housing prices with multiple accessibility variables.

While we are ultimately interested in the causes of multinucleation, in this paper we emphasize the empirical evidence for the phenomenon. The dispersion of the land price surface in Bogotá, and by implication the emergence of subcenters, can be seen in Table 20. This table lists the comunas with the highest land prices in 1955, 1960, 1965, 1970, 1975, and 1978. Not surprisingly, over time the higher land prices move from a group of comunas all located adjacent to downtown, to comunas located farther to the north. A corridor analysis is also revealing. Figure 1 shows averages of real land prices in neighborhoods along Bogotá's main north-south corridor, during the periods

Table 20

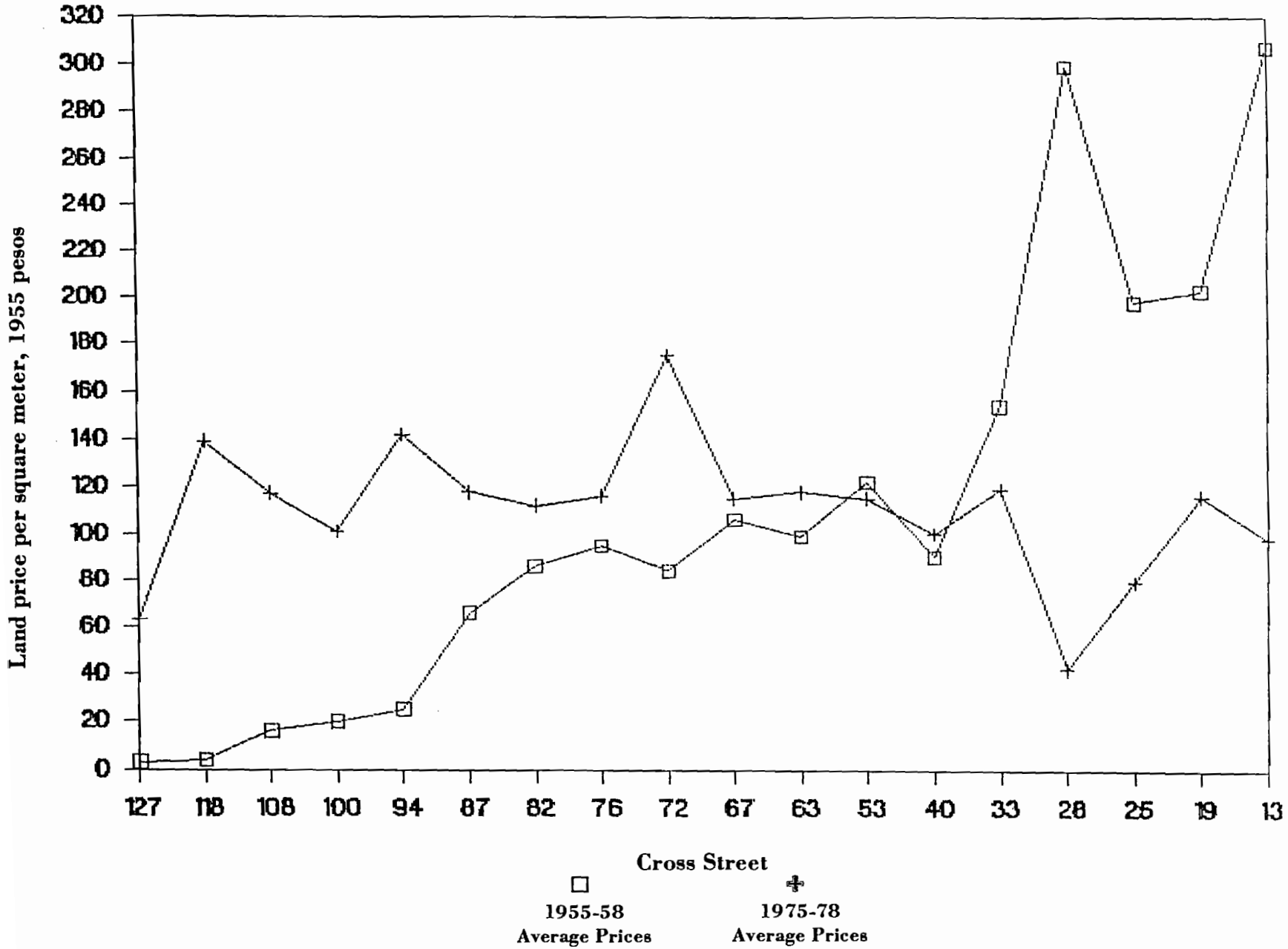
The Ten Comunas with the Highest Land Values: 1955, 1964, 1973, 1978

1955	1964	1973	1978
31	31	31	83
12	61	73	82
21	32	41	31
61	82	61	81
41	41	23	61
82	71	82	84
71	72	71	53
72	81	72	72
81	73	83	73
32	83	42	62

SOURCE: Authors' calculations from World Bank Bogotá land price data.

Figure 1.

Average Land Prices Along Bogotá's Main North-South Corridor



Source: Authors' calculations from World Bank Bogotá land price data.

1955-1958 and 1975-1978. Over time, the corridor developed more pronounced peaks away from the CBD. Prices in and near downtown have declined, while those farther to the north have increased substantially.

A more rigorous way of showing the transition from monocentric to polycentric city is by estimating land value gradients from more than one point at a time. As an urban area becomes multicentered, land values in a given location are increasingly a function of distance from points other than the CBD. While the most common conception of multinucleation is that individuals or households value accessibility to every subcenter, it is also possible to formulate models in which individual decision-making units care only about a subset of these points. Clearly, a model of land values based on access to multiple centers is appropriate when different members of a household carry out their primary activity in different zones, or individuals have a set of activities which take place at dispersed locations. Because the labor force participation rate for women in Bogotá is fairly low (45 percent, compared with 75 percent for men (Bogotá. Alcaldía Mayor, 1987)), we might expect that access to multiple centers would be less important than in large urban areas of the United States. Furthermore, using the division of Bogotá into six rings, as shown in Map 7, we find using data from Mohan's (1986) book that in 1978 almost half of the city's labor force lived in the same zone in which it worked. Nevertheless, individuals and households do make many trips for other purposes, such as shopping, studies, and personal business. Survey data indicate that with Bogotá divided into nine zones, 71 percent of trips on public transportation are inter-zonal (Bogotá. Alcaldía Mayor, 1987). We thus feel that it is appropriate to test a model which has land prices at the zonal level as an additive function of the distance from one or more centers of attraction. The comunas chosen as subcenters are 31 (the CBD), 82 (Chapinero), 84 (the area around the shopping center Unicentro), and 43 (an area which includes a large industrial zone) [refer to Map 6, 7, or 8 for their location]. Comunas 31, 82, and 84 are clearly major centers of employment and commerce, and at different times each of these three areas has contained the city's most expensive land. Comuna 43 represents a center of industrial employment and some commerce.

Our analysis of land value gradients from multiple centers uses the World Bank summary data set, which contains average land prices at the comuna level for each of the years 1955-1978. Distances are the centroid distances between pairs of comunas, except that intra-zonal distances are from travel data.

Table 21 lists the gradients estimated for the periods 1955-1959 and 1974-1978, using linear and log-linear forms. The overall fit of the models, as measured by the adjusted r-square, is better for the earlier than the later time period, and better for the log-linear than the linear form. In the model with all four centers, the variable representing distance from comuna 43 does not have the expected negative sign. Distance from comuna 43 is highly correlated with distances from comuna 31 (r=.68) and from comuna 84 (r=-.62), and the influence that accessibility to these latter two areas exerts on land values overwhelms the influence of distance from comuna 43. When we restrict our analysis to comunas whose centroid is seven kilometers or less from the centroid of 43, we are finally able to obtain a negative coefficient for the distance from 43. However, this negative coefficient is only for the years 1974-1978, and is not statistically significant.

Our estimation of land value gradients from multiple centers provides further evidence of the importance of Bogotá's main north-south corridor in the city's spatial structure and land market. However, since our data at the comuna level end in 1978, they do not capture the full impact of the emerging multi-nucleation. The isoprice maps included in the FEDELONJAS study (1988) reveal a greater dispersal of peaks in land values during the 1980s. The color map in Durán de Gámez (1988) is an even more useful tool for understanding what has been happening. What the map shows is that the area of high land values in Bogotá encompasses most of the area east of the Avenida Caracas-Autopista del Norte corridor, from Calle 13 to Calle 161. "Fingers" of high land values, often corresponding to the areas adjacent to major transportation corridors, extend to the west. In the lower-income south and southwest of Bogotá, there are "islands" of higher land prices in comuna 43, one of our subcenters in the analysis presented above. Other, smaller areas of higher-value land are found in the middle-class residential areas the the west of Carrera 10 near Calle 22 Sur (comuna 14), and to the north of Calle 27 Sur between the Autopista del Sur and Avenida 30 (comuna 23). Finally, the residential and commercial zones of Venecia (comuna 24) and Ciudad Kennedy (comuna 45) have land values substantially higher than in surrounding areas.

We have documented Bogotá's transition to a multicentric city, but more work is needed before we can have a theory of subcenters. While we know what some of the factors behind multinucleation are, we do not have an integrated theory which relates specific economic and institutional conditions to

Table 21

Land Value Gradietns from Multiple Centers,
Bogotá, 1955-1959 and 1974-1978

43, 82,	Estimated Gradients							
	Linear Form				Log-Linear Form			
Years	Comuna 31	Comuna 43	Comuna 82	Comuna 84	Comuna 31	Comuna 43	Comuna 82	Comuna 84
1955-59	-106.13(-8.71)				-.199(-11.55)			
1974-28	-18.72(-3.75)				-.024(-4.58)			
1955-59	-139.61(-11.0)			-57.57(-5.47)	-.270(-17.47)			-.123(-9.60)
1974-78	-23.95(-4.93)			-28.15(05.47)	-.031(-6.30)			-.038(-6.08)
1955-59	-154.67(-6.23)	-52.67(2.21)	-9.26(-.301)	-38.14(-.163)	-.211(-7.05)	.058(2.00)	-.102(-7.72)	-.052(-1.84)
1974-78	-8.42(-1.58)	38.82(2.57)	-69.76(-5.34)	7.73 (.722)	-.012(-2.26)	.023(1.55)	-.076(-5.94)	-.006(-.621)

t-values in parentheses.

SOURCE: Authors' calculations from World Bank Bogotá land price data.

particular spatial forms. We feel that the main factor in the relative decline of Bogotá's traditional CBD has been the absence of a strong political coalition pushing for revitalization of central areas. This "lack of will" has manifested itself in the failure of the government to go ahead with plans for a rapid transit system, and the low level of interest that private developers have shown in investing in downtown. The abandonment of the center does not completely explain multinucleation, however, because subcenters are also emerging in cities such as Sao Paulo, which have metros and strong downtowns. Ultimately, the particular form that multinucleation takes would seem to result from the interaction of institutional decisions (including land use regulations) and the transportation system. In our future work we will continue efforts to develop a theory or typology of polycentric urban areas.

Land Prices and the Production of Housing

In their simplest formulation, models of residential location based on access to a central location or locations discuss the demand for "space" without explicitly considering the production process. However, there is also an extensive body of literature dealing with the elasticity of substitution between capital and land in construction.

Among the authors who discuss land-capital substitution are Müth (1964; 1969; 1971), Koenker (1972), Clapp (1979, 1980), Sirmans and Redman (1979), Neels (1981), McDonald (1981), and Kau, Lee, and Sirmans (1986). Work in the United States has progressed to the point that the key issues are functional forms and the further disaggregation of the "nonland" input. However, in the context of developing countries very little basic estimation work has yet to be done. The study of land-capital substitution in Accra, Ghana by Asabere, et.al. (1982) is one of the few done in the context of developing countries.

The technical definition of the elasticity of substitution (Es) refers to the ease with which inputs substitute for each other along an isoquant. However, assuming the familiar profit-maximizing condition of the ratio of marginal products equal to the ratio of input prices, the elasticity is also equivalent to the percentage change in the ratio of input quantities, divided by the percentage change in the ratio of input prices. In symbols:

$$Es = d(K/L)/(K/L) \;/\; d(r/n)/(r/n)$$

$$= d(K/L)/d(r/n) * (r/n)/(K/L) \qquad = d\ln(K/L)/d\ln(r/n)$$

where K = the nonland input ("capital")

L = land

n = the per-unit price of capital

r = the per-unit price of land

ln = the natural logarithm

By rearranging terms in the above definition, we obtain a very simple formulation for the (constant) elasticity of substitution formulation

$$\ln(K/L) = a + b \ln(r/n)$$

This form allows for straightforward empirical estimation in which the coefficient b is the (constant) elasticity of substitution. Most work on land-capital substitution has used CES forms equivalent or similar to the one above. Nevertheless, as Kau, Lee, and Sirmans (1986) point out, it is unlikely that the elasticity is the same at all points on a given isoquant. With the variable elasticity of substitution (VES) functional form, the elasticity is a function of the land/capital ratio. Revankar's (1971) version of the VES function is

$$H = L^{Á\,(1\,-\,Šp)} \left[K + (p-1)\,L\right]^{ÁŠp}$$

This equation gives the following form for the elasticity:

$$Es = 1 - A\,(L/K)$$

where A is a coefficient obtained by regressing the input price ratio on the ratio of structure value to land value.

While technically the elasticity of substitution is defined in terms of a production function, the input-output relationship estimated from observed data reflects both tastes and technical relationships (see Muth, 1969 and Arnott, 1978, for further discussion of this point).

With land and housing markets less constrained by zoning laws, and non-poor consumers less attached to the single-family detached house as the ideal dwelling, we might expect to find in Bogotá a greater responsiveness of land use to changes in land prices. Work in the United States (reviewed in McDonald,

1981) generally gives estimates of .5 to .75 for the land-capital substitution elasticity. If we consider the "price" of capital to be a constant, the elasticity of substitution can be measured empirically by examining how the capital/land ratio varies as the price of land changes. Measuring capital intensity in housing is fraught with difficulties. Two intuitively appealing measures, the number of floors and the amount of built space per unit of land, fail to compensate for differentials in construction quality between buildings. An initial attempt to regress the natural logarithm of 1978 land prices on the average number of floors in each of six rings emanating from the center of Bogotá gave an elasticity of substitution of 1.78. This figure seemed unrealistically high, both from a theoretical point of view, and in light of results obtained in US studies. More reasonable results were obtained by using the FEDELONJAS land price data and our data set of new housing developments in Bogotá, both described earlier in this paper. Regressing the natural logarithm of land price in 1987 pesos on the value of the structure per unit of land, also in 1987 pesos. gives the following equation:

$$\ln(K/L) = 5.90 + .69 \ln(r) \qquad \text{adjusted r-square=.42}$$

(based on 587 observations)

The substitution elasticity of .69 is consistent with the upper range of values reported by McDonald (1981) in his review article. These results lend credence to our hypothesis that land use is more responsive to relative factor price changes in Bogotá than in the United States. In our larger study of spatial structure in Bogotá, we are exploring the effects on elasticity calculations of different functional forms.

A well-known result of the Alonso-Mills-Much models is that households make tradeoffs between "space" and accessibility, with accessibility in turn being the driving force behind land values. On the supply side, rising land prices bring about a substitution of capital for land. It is useful to think of this capital as consisting of two components: built space and quality. As land becomes more expensive, we expect to see taller and/or bulkier buildings. After compensating for differences in household income, the housing units in areas with expensive land are likely to be both smaller and of higher physical quality than those built in low-cost land areas. Taller buildings and smaller housing units together imply higher residential densities.

It is interesting to note that the elasticity estimate for Accra, Ghana calculated by Asabere, et.al. using the CES form, was .53. This figure is consistent with the low end of the range reported by McDonald. The authors attribute this low value to "the limited range of technological opportunities available for housing production" (p. 195). However, the authors themselves recognize that a number of objections can be raised to their measure of capital intensity, which is simply square feet of living space. We have greater confidence in our elasticity calculation for Bogotá.

HOUSING DEVELOPMENT IN COLOMBIA AND BOGOTA

The Magnitude of the Problem--Estimates of the Housing Deficit in Colombia

Housing shortages are very real to those individuals who suffer from inadequate shelter, but estimates of housing deficits depend very much on the socially-defined standards of a particular society. Rather than the precise economic definition of a shortage as the quantity demanded exceeding the quantity supplied at the existing market price, housing shortages are usually quantified by measuring floorspace per person, or by comparing the number of individuals and groups who consider themselves separate households, with the number of dwelling units available. The former gives an idea of how adequate the existing housing stock is for those who occupy it, while the latter gives us an idea of the absolute shortfall in the number of dwellings. Using the second approach, estimates of the national deficit in Colombia from the early 1980s ranged from one-half million to 1.2 million housing units. The rural housing problem is more the inadequacy of the dwellings than the absolute lack of housing units. Although the government estimates that there are 200,000 rural households in need of a dwelling, this is a small number compared with the estimated 1.3 million houses that need repair work (Robledo, 1985).

A number of factors work together to create a potentially very high demand for additional dwelling units in Colombia. In addition to the increase in total population and even greater increase in urban population, the process of economic development in itself encourages household formation, as different generations of a family live under separate roofs.

Three separate estimates for Bogotá during the early 1980s indicated that the housing deficit was around 200,000 units (Landerretche, 1986). This figure

is remarkably high, considering that the estimate of the city's total housing stock from the 1985 census was 850,000 units. Regardless of the precise magnitude of the shelter deficit, under present conditions formal-sector construction would be unable to close the gap between supply and potential demand. From 1980 to 1984, a total of 13,800 construction licenses for housing were issued in Bogotá. These licenses represented 9.3 million square meters of built space (Colombia. DANE, 1985). Given the trend toward reduced dwelling size in new formal-sector building, these licenses might have represented up to 100,000 housing units. During this same period, the population of Bogotá grew by at least 350,000. Thus, while the amount of space represented by the licenses could have housed the increment in the city's population, it would not have eliminated the existing huge deficit. Furthermore, we would have to consider the impact of the loss of existing housing stock, plus the very important fact that projects that are issued licenses are not always built.

The demographic projections made by the Bogotá Chamber of Commerce indicate that the population of the Colombian capital will increase by almost two million during the period 1985-2000. Using as a very rough estimate the figure of one new household for every five new inhabitants, the implication is that there will be a net addition of around 400,000 households during this period.

Housing in Bogotá--Forms of Production

There exist two very different estimates of the total number of housing units in Bogotá. Calculations made at the barrio level for 1980 indicated that there were 542,000 dwelling units in the city (Table 22), while the 1985 census reported 849,000 units. The number of housing units might well have increased by 10 to 15 percent during the period 1980-1985, but the rest of the difference is probably due to a combination of sampling error and differences in the way of counting structures with multiple dwellings. Table 23 gives information on Bogotá's households according to the characteristics of their dwelling unit. Table 24 compares the housing stock in the four largest Colombian cities.

The housing stock of Bogotá represents a tremendous capital investment, the magnitude of which cannot be fully appreciated by looking only at the monetary value in dollars. The rigors of the city's climate are such that even in pirate subdivisions and areas of invasion, it is unusual to find a dwelling that is not solidly constructed. Only the poorest and newest arrivals to these

Table 22

Number of Neighborhoods, Blocks, Buildings, and Housing Units, by Comuna, Bogotá, 1980

Comuna	Area (hectares)	Number of Neighborhoods	Number of Blocks	Number of Buildings	Number of Housing Units	Housing Units per Hectare
11	431	15	320	5,251	7,403	17.2
12	223	10	262	5,276	6,656	29.8
13	836	32	1,467	22,478	25,452	30.4
14	383	10	434	9,576	13,118	34.3
21	251	7	311	7,241	10,768	42.9
22	169	5	288	6,903	8,500	50.3
23	280	10	328	8,687	11,922	42.6
24	1,174	15	714	13,944	17,853	15.2
25	2,190	36	2,076	34,514	36,522	16.7
31	398	10	325	6,163	12,418	31.2
32	294	16	387	8,913	9,554	32.5
41	381	11	500	10,453	13,837	36.3
42	485	12	591	10,349	12,580	25.9
43	281	9	306	8,752	12,198	43.4
44	588	16	907	18,020	20,601	35.0
45	2,851	39	3,166	56,058	66,852	23.4
51	881	15	516	6,435	11,003	12.5
52	209	6	310	6,279	10,163	48.6
53	439	8	421	7,083	9,200	21.0
54	442	6	387	9,349	11,629	26.3
55	462	10	410	10,043	11,637	25.2
56	3,679	33	1,913	38,989	46,762	12.7
61	278	8	214	3,654	7,171	25.8
62	417	11	268	3,631	5,108	12.2
63	1,224	18	362	5,942	5,531	4.5
64	1,147	18	648	13,637	16,387	14.3
65	767	9	378	6,050	6,221	8.1
71	189	7	239	4,059	6,954	36.8
72	270	9	321	6,398	10,503	38.9
73	265	12	294	7,304	8,862	33.4
74	174	7	215	4,828	6,043	34.7
81	215	9	170	2,507	5,060	23.5
82	498	16	368	6,274	12,239	24.6
83	670	15	468	5,922	12,921	19.3
84	1,178	18	735	9,161	11,829	10.0
85	2,076	36	931	14,992	14,421	6.9
91	2,518	23	1,100	14,924	15,236	6.1
92	1,209	15	687	10,484	10,591	8.8
Total Bogotá	30,424	562	23,737	430,523	541,705	17.8

SOURCES: Colombia, DANE, 1980. Mohan, 1980.
NOTE: The 1985 census reported 849,000 dwelling units in Bogotá (see text).

Table 23

Distribution of Households in Bogotá
According to Characteristics of the Dwelling Unit, 1985

Type of Dwelling	Percent of Households
House	50.5
Apartment	25.8
Room in a house	12.1
Room in an apartment	2.2
"Inquilinato" roominghouse (see text)	7.9
Improvised dwelling	.7
Non-residential building	.8
Number of Rooms Available to Household	
One	23.0
Two	22.5
Three	21.2
Four or more	33.3
Tenure	
Owned by occupant; paid for already	39.1
In process of acquisition	11.0
Rented	41.8
Squatting and other forms of "de facto" occupancy	7.5
Construction work done on dwelling in the last two years	
No	79.1
Yes	20.8
Addition	54.6
Staged construction	17.4
Maintenance	35.7
Family members participated in work	55.6
Households with a family business	
Within the dwelling	21.0
Outside	18.0
None	61.0
Percent of households owning	
Refrigerator	56.9
Blender	81.6
Washing machine	19.3
Dishwasher	2.3
Cooking done primarily with	
Cocinol (a gasoline derivative)	34.8
Gas	28.4
Other petroleum products	9.8
Coal, wood, or charcoal	.9
Electricity	26.1

SOURCE: Bogotá, Alcaldía Mayor, 1987.

Table 24

Housing in the Four Largest Colombian Cities, 1985

	Population*	Number of Housing Units	Persons per Housing Unit	Type of Dwelling (percent) House, "Rancho"	Apartment, Room	Average Number of Rooms per Dwelling Unit	Housing Tenure (percent) Own	Rent	Other
Bogotá	4,176,929	849,324	4.9	60.3	39.0	3.3	57.1	39.9	3.0
Medellín	1,550,896	284,424	5.5	80.2	19.8	4.1	64.9	30.3	4.8
Cali	1,418,747	250,031	5.7	81.7	18.3	3.7	68.5	27.4	4.1
Barranquilla	936,468	152,773	6.1	82.5	17.5	3.9	72.5	23.3	4.2
Total Colombia	27,867,326	5,903,058	4.7						

*Adjusted census figures from Bogotá, Alcaldía Mayor, 1987.

SOURCES: Colombia, DANE, 1986; Bogotá, Alcaldía Mayor, 1987.

neighborhoods have housing made of "improvised" materials such as scrap wood. Brick and concrete predominate, and with time the clandestine subdivision takes on the appearance of a stable low-income neighborhood.

In the face of formidable obstacles to data collection, Jaramillo (1980) has written an excellent analysis of the political economy of housing in Bogotá, from the 1930s to the 1970s. Particularly useful is his emphasis on forms of production. Jaramillo classifies formal-sector residential construction into production "on demand," (a single unit); "transitional" production (2-3 units); and "promotional" capitalist production (four or more units). As Table 25 shows, the trend from 1944 to 1977 was toward a declining role for on-demand production, and an increased share for the transitional and capitalist forms. From Tables 26 and 27, we see that the ICT played an important role in housing production, especially during 1951-1964. This period includes the early years of the Alliance for Progress, when state-assisted housing was a top priority. During the three-year period 1962-64, when ICT production peaked, almost half of all dwelling units constructed legally in the Colombian capital were the responsibility of that entity. The ICT was the force behind an estimated 21 percent of all housing units constructed in Bogotá between 1951 and 1964, and 15 percent of units constructed between 1964 and 1973.

Unlicensed autoconstrucción (self-help housing) has persisted as an important form of shelter provision in the Colombian capital. According to Jaramillo's calculations, "informal" self-help building was responsible for around half of Bogotá's new dwellings for most of the period between 1938 and 1973. During the years 1951 to 1964, the proportion fell to one-fourth, in part because of the high level of ICT activity, much of it "directed" self-help.

Jaramillo's calculations show that, between 1930 and 1970, the number of legal dwellings constructed for each net increase of 100 in Bogotá's population varied from four to eleven. His estimate of legal construction between 1950 and 1973 is 224,075 housing units. According to census figures, between 1951 and 1977 the population of Bogotá increased by 2,217,000. While some of this increase came through the incorporation of already-housed population in outlying municipalities, it is clear that the amount of legal building was insufficient to house the increase in population. Jaramillo's own estimate is that autoconstrucción, self-help housing not built with assistance from the ICT, accounted for 26 percent of the new housing units built between 1951 and 1964, and 50 percent of the units built between 1964 and 1973 (Table 27).

Table 25

Forms of Production of Licensed Residential Construction in Bogotá, 1944, 1954, 1964, 1970, 1977
(based on a sample of licenses)

Year	Percentage of Licensed Units Constructed by Form of Production			
	On Demand	Transitional	Capitalist	Total
1944	32.00	11.80	56.20	100.00
1954	25.92	10.67	63.41	100.00
1964	35.10	13.80	51.10	100.00
1970	28.11	16.69	55.20	100.00
1977	11.62	24.21	64.17	100.00

NOTE: See text for explanation of terms.

SOURCE: Jaramillo, 1980.

Table 26

ICT Housing Production in Bogotá, 1950-1976

Year	Number of Units
1950	41
1951	1,068
1952	-
1953	1,103
1954	910
1955	1,202
1956	156
1957	731
1958	996
1959	415
1960	1,001
1961	1,164
1962	10,186
1963	2,141
1964	1,976
1965	560
1966	1,401
1967	4,015
1968	3,252
1969	3,166
1970	2,821
1971	4,815
1972	4,217
1973	8,008
1974	2,087
1975	3,432
1976	2,812
TOTAL	63,676

SOURCE: Jaramillo, 1980.

Table 27

Estimates of the Shares of Licensed Private-Sector Construction, ICT Units, and Unlicensed Self-built Housing, in Total Housing Production, Bogotá, 1928-1973

Years	Percentage of Total Housing Production Represented by: Licensed Private-Sector Construction	ICT	Licensed Self-Built Housing
1928-1938	70.0	-	30.0
1938-1951	40.9	4.2	54.9
1951-1964	52.9	20.9	26.2
1964-1973	35.3	15.0	49.7

SOURCE: Jaramillo, 1980.

In the same way that Mohan and Villamizar's work came just as Bogotá was undergoing important spatial changes that would have a profound impact on land markets, Jaramillo's study appeared at a time of transition in housing markets. His book covers the period up to 1977. By this time, the UPAC system was already well-established, but the following decade would be characterized by a significant transition to multifamily housing and the formation of conglomerates which would control multiple aspects of housing production and promotion. An equally important change in low-income housing began in the 1970s, with the implementation of "minimum norm" subdivisions. As we discuss elsewhere in this paper, this new form of housing production became a partial, but not complete, substitute for dwellings in pirate subdivisions.

The Tenure Decision--Owned versus Rental Housing

Home ownership is an important goal for most Colombian households. Both economic realities (shaped by government policy) and official ideology favor ownership as the tenure of choice. There will always be a significant minority of households for whom ownership, with its long-term financial commitment, is inappropriate. At the same time, some urban tenants in Colombia have practiced what could be termed de facto squatting, by successfully resisting rent increases in a highly inflationary environment. For most households, however, the security that comes from owning, and the lack of other investments earning an equally attractive real return, are compelling reasons to attempt to purchase their dwelling.

As we have mentioned already, while the fact that Bogotá has the highest proportion of renters of the four largest cities of Colombia is an indication of decreased housing affordability, this fact should be balanced against the greater amenities offered by the capital. In addition, precisely because Bogotá is the national capital, the largest city, and the cultural, educational, and financial center of Colombia, it has a higher proportion of residents who are recent arrivals and/or whose intended stay in the city is short-term.

As is typical of many developing countries, in Bogotá much of the rental activity consists of individual households that rent out part of their dwelling, often to other family members. A 1985 household survey found that 14 percent of households in Bogotá occupied a room in a house or apartment. Practically

the same percentage of households (including both owners and renters) reported that they rented out part of their dwelling (Bogotá. Alcaldía Mayor, 1987).

The poorest households in Bogotá must frequently accept a type of semi-communal rental accommodation known in Colombia as inquilinato. The source for this type of shelter has traditionally been large old residences in the central part of the city. Unlike self-built housing, which is defended by many observers as a legitimate, low-cost answer to the shelter crisis of the poor, the inquilinatos are universally condemned as a degrading and totally inadequate dwelling solution. Eight percent of the households in Bogotá make their home, such as it is, in this type of housing (Bogotá. Alcaldía Mayor, 1987).

Housing Ownership and the Poor

Both the 1985 census and a Universidad de los Andes household survey from the same year classify approximately 60 percent of households in Bogotá as owners. These figures include households that own their dwelling free and clear, those that are in the process of acquiring it, and those who are de facto owners.

Home ownership among the poor takes primarily the form of "informal" (i.e., unregulated and self-built) housing. Hamer (1985), Mohan (1985), and Gilbert and Ward (1985) quote a variety of sources, to the effect that at least one-third of all households in Bogotá are living in structures they built themselves and that half or more of all housing units in the city have "clandestine" origins. Many neighborhoods which began as "pirate" subdivisions have over time been legalized and have acquired a physical appearance which is little different from that of formal-sector subdivisions.

The heavy dependence on self-built housing as a shelter solution for Bogotá has never ceased to be controversial. Proponents have rallied around the ideas typified in the book edited by Turner and Fichter (1972). In its briefest form, the argument in favor of self-built housing is that, given the inability and/or unwillingness of the state and private developers to provide shelter for the poor, self-help building provides an acceptable, affordable alternative. A progressive tinge is added to the argument through the claim that self-built housing means freedom and empowerment for the poor. These points of view have been adopted at various times by international organizations such as the World Bank.

Colombia has articulate opponents of self-help housing on both sides of the political spectrum. On the "left," authors such as Robledo (1985) and Janssen (1984) accuse the defenders of informal-sector housing of "confusing the problem with the solution." In other words, self-built housing is a manifestation of the shelter crisis rather than its cure. The apparent low costs of the dwellings are misleading; they are consequences of the self-exploitation of the owners, who must devote many hours of their time to building activities. In addition, the term "self-built" is a misnomer, because it is often necessary to contract outside labor to assist with the construction. The criticism of autoconstrucción which comes from the "right" is best exemplified by Currie (1976). He argues that self-built housing is a backward form of production which provides inadequate shelter and which does not have the same potential for stimulating the economy as does modern, formal-sector construction.

Minimum Norm Subdivisions

As mentioned in the earlier section on land markets in Bogotá, one government response to the proliferation of illegal or "pirate" subdivisions has been the program of "normas mínimas" (minimum standards), which provides lots with basic infrastructure through officially-sanctioned private developers. Minimum-norm subdivisions represent an effort to provide an intermediate form of housing production, between unregulated autoconstrucción and formal-sector building. These subdivisions had their institutional beginning in Bogotá with the city council's Acuerdo 20 of 1972, as well as the general land use plan of 1979. Minimum norm subdivisions reflect the uneasy balance of tensions characteristic of housing policy in many developing countries. On one side are the monetary savings and the ostensibly progressive nature of self-built housing (as expressed in Turner and Fichter's Freedom to build [1972]). On the other side are the disappointing realities of poor living conditions and chaotic spatial development characteristic of private developments. The hope of policy-makers in Colombia was that a program by which developers would sell serviced lots under government supervision would eventually do away with pirate subdivisions. Molina (1989) emphasizes the fact of the persistence of barrios clandestinos. However, the data which he presents, which cover through the end of 1985, do show a substitution of minimum-norm development for pirate subdivisions. During the decade of the 1970s, minimum-norm developments

represented 11 percent of the newly-developed area of Bogotá, as compared with a share of 24 percent for pirate subdivisions.

By December 1983, eleven years after a formal program of minimum norm developments was begun, the District Planning office had approved 93 subdivisions containing 53,612 lots with services. Of these, 10,998 were lots with communal services, destined for the very poorest households. Another 28,580 lots had individual services. Housing for both types of lots was self-built, but in the latter case the directed self-help method was predominant. A third category of minimum-norm developments consisted of 14,034 lots with one or more basic structures built on them.

An overwhelming majority of the minimum-norm developments are located in the south of Bogotá. The municipal administration has explicitly zoned lands for progressive development in this area. In addition, the area of Ciudad Bolivar contains a large amount of land zoned as Areas of "Agrological" Activity (crops, livestock, and timber) III. These are lands of relatively low agricultural potential, and by law may also be used for low-income housing built by official entities, mixed (public/private) ventures, or cooperative associations.

Molina (1989) considers that the minimum-norm programs have had an unintended deleterious effect on land and housing markets. According to Molina, the Caja de Vivienda Popular and the Instituto de Crédito Territorial, (two official entities devoted to providing shelter for low-income households) have entered into the land market without negotiating their purchases carefully. The result has been that land prices have been pushed up. In addition, the private developers who have chosen to participate in sites and services programs have been able to exert monopoly power and push up the price of the lots they offer for sale.

Credit Markets, UPAC, and Housing in Colombia

Research on informal-sector housing in Colombia has rightly emphasized the financial burden of acquiring a small plot of land on which to build. While land prices certainly have an effect on the cost of formal-sector dwellings as well, the process of densification (especially evident in Bogotá) helps to mitigate the impact. Because the purchase of formal-sector housing brings to most households a very large, long-term, debt burden, the cost of credit becomes one of

the most important components of total housing costs, and is highly vulnerable to even small changes in the interest rate.

A specialized credit system for long-term financing is indispensable for the large-scale capitalist development of the construction industry. In 1932, with over 70 percent of Colombia's population still rural, the quasi-governmental Banco Central Hipotecario (BCH [Central Mortgage Bank]) was established. However, it was not until 1953 that housing became the focus of the BCH's activity. With time, the BCH acquired a role as the main source of housing finance for middle- and upper-income households. Its companion organization, the Instituto de Credito Territorial (ICT), was founded in 1939 as a provider of credit to the rural poor. Since 1956, however, its focus has been the low-income urban population (Robledo, 1985).

The BCH and ICT dominated the "middle ground" of housing finance in Colombia until the 1970s. Informal-sector housing operated outside of the regular government and private financial network, while the very rich had access to their own substantial finances, as well as conventional bank loans.

The Colombia of the 1970s was very different from that of the 1930s. The demand for housing on the part of the growing urban middle class was far greater than the BCH could satisfy, and at the same time the government of President Misael Pastrana Borrero was seeking to implement a strategy of using construction as a "leading-sector" or development "motor." Pastrana Borrero instituted sweeping changes in the country's financial system. According to Robledo (1985), the state faced three crucial problems in the area of housing finance: how to convince the private banking sector to form savings and loans, how to convince the bankers that the combination of short-term deposits and long-term loans did not present undue risks, and finally, how to make long-term credit affordable in an environment characterized by high inflation and interest rates.

The incentive offered to the financial sector for setting up savings and loans institutions (Corporaciones de Ahorro y Vivienda [CAVs]) was threefold. A higher interest rate was allowed to be charged to borrowers, and the state promised to intervene with monetary emissions in the case that a CAV was threatened with insolvency. The most notable aspect of the new financial system, however, was the introduction of "monetary correction." This innovation allowed adjustments in payment schedules to compensate for inflation, without technically violating the constitutional prohibition against charging interest on interest (Robledo, 1985; Mondragón, 1979).

The system of monetary correction was baptized with the name of UPAC, Unidad de Poder Adquisitivo Constante (Unit of Constant Purchasing Power). While the UPAC system has been very controversial within Colombia, the basic concept of indexing or adjusting loan payments to compensate for inflation was hardly a new idea. What distinguishes the most publicized type of UPAC loans from the "balloon" mortgages, Adjustable Rate Mortgages (ARMs), and other forms of "creative" financing familiar to U.S. borrowers, is that, in a UPAC loan, the rate and term are fixed, but the payments are calculated in UPACs, whose nominal value in pesos fluctuates. Montenegro (1982) provides a useful example of how a UPAC loan behaves (Table 28). Using his illustrative figures, suppose one purchases a house or apartment for three million pesos, with a 20 percent down payment, and 15 years (180 months) to pay the balance. The annual compound interest rate is 7.5 percent, about .6 percent monthly. Suppose, in addition, that the initial value of the UPAC is 700 pesos, so that the balance of 2.4 million pesos is equivalent to 3,429 UPACs. The monthly payments would be 31.20 UPACs. This amount would initially be equivalent to 21,841 pesos, but with "monetary correction," the payments in pesos would be expected to increase substantially over time. In Montenegro's example, the annual monetary correction and the annual percentage increase in income are both 23 percent. The monetary correction should in theory be equal to the rate of inflation, and thus the real burden of the UPAC loan is spread evenly throughout the period of repayment.

Robledo's (1985) argument that borrowers are paying more for credit under the UPAC system is correct if we consider total payments in nominal terms, but there is no inherent reason why total payments in real terms should be greater. If anything, the reduction in uncertainty that comes from monetary correction should cause lenders to accept a lower expected return. In any case, the value of UPAC has not kept pace with inflation since 1977 (Giraldo Isaza, 1987).

The Evolution of UPAC

The seeds of the UPAC system were planted by DNP advisor Lauchlin Currie, in his diagnosis of the Colombian economy titled "Operation Colombia" (1960). The professed ultimate goal of Currie's strategy was to harness the forces of production and raise incomes. Housing was more important as a means to an end (a way to stimulate the economy), than as an end in itself.

Table 28

Comparison of a UPAC Loan with a Conventional, Fixed-Payment Loan

Monthly Payment Number	Fixed Monthly Payment in Pesos	Value of One UPAC in Pesos	Monthly Payment Under UPAC System	Monthly Payment in UPACs	Monthly* Income
1	57,050	712	22,214	31.20	101,740
12	57,050	861	26,863	31.20	125,139
24	57,050	1,059	33,041	31.20	153,919
48	57,050	1,602	49,982	31.20	232,860
96	57,050	3,667	114,410	31.20	532,964
144	57,050	8,393	261,862	31.20	1,219,836
180	57,050	15,617	487,250	31.20	2,269,884

*Assuming a percentage rate of increase equal to monetary correction, 1.74 percent monthly. The installment payments are made at the end of the month.

SOURCE: Montegegro, 1983.

The UPAC system was introduced into a financial environment which offered few opportunities for households of moderate means to earn a significant real return on their savings. In 1971, the year before UPAC was begun, BCH certificates paid interest of 11.5 percent, while inflation reached 14.1 percent. The following year, certificates were paying 9.5 percent, while inflation shot up to 22.1 percent. Not surprisingly, this "strangulation" of savings (as Giraldo Isaza [1987] calls it), was accompanied by a decline in the share of construction in GDP: from 3.4 percent in 1970, to 2.7 percent in 1972. The UPAC came into existence in May 1972, with a government decree establishing a system of constant value for savings deposits and construction loans. Another decree created the Corporaciones de Ahorro y Vivienda. It was expected that the new system would draw deposits away from other savings instruments, but also stimulate new domestic saving, as well as an influx of foreign funds.

The 1974 financial reforms of Liberal president López Michelsen attempted to dismantle the UPAC system, by placing limits on, and taxing, monetary correction. López and his economic team alleged that UPAC was inflationary, and was diverting investment away from industry. However, the system was already well-enough established that political pressures from CAVs and builders kept the reforms from totally eliminating the attractiveness of the UPAC as a savings instrument (Giraldo Isaza, 1987).

From the very beginning of UPAC, there were stipulations as to the distribution of credit. Initially, at least 50 percent of the credit was to be destined for dwelling units valued at 4,000 UPACs or less. This was a very mild restriction, for in 1972 4,000 UPACs represented fairly luxurious construction. Later legislation attempted to orient the UPAC system toward a progressively greater role in low- and middle-income housing. Decree 893 of April 1981 eliminated CAV financing for housing units valued at 10,000 UPACs (4.37 million pesos at that time) or more. At the other end of the price spectrum, at least 22 percent of credit loaned out was to be destined for housing costing no more than 2,500 UPACs. These restrictions have been modified periodically, along with the limits on monetary correction and interest rates.

After two Liberal administrations (López and Turbay) not known for their sympathy toward the UPAC system, populist Conservative Belisario Betancur assumed the presidency in 1982. He pushed for increases in the returns earned by UPAC depositors, and in the minimum quotas of credit destined to lower-cost housing. Nevertheless, by December 1983, the after-tax return to UPAC investments was

not markedly superior to that of other savings instruments, and was considerably below that of Certificates of Deposit issued by private banks (Giraldo Isaza, 1987).

Liberal President Virgilio Barco has continued his party's traditional lack of enthusiasm toward UPAC. His administration has eliminated many of the tax advantages of UPAC deposits, which already paid a lower before-tax return than other savings instruments (Giraldo Isaza, 1987). By 1988, the UPAC system faced what the builders' association politely referred to as a "delicate" situation. Net deposits during the first quarter were less than two-thirds of the nominal level one year earlier ("Crisis en el UPAC," 1988). While opponents of the system claim that it is inflationary, the real value of a UPAC has fallen by more than one-third since its inception in 1972. As Jaramillo (1982) points out, the degree of stability in net CAV deposits (at least through the early 1980s) is surprising. This stability can perhaps best be explained by the high liquidity of UPAC deposits, which makes them almost like interest-bearing checking accounts.

The significance of UPAC goes beyond indexation. The introduction of the system of monetary correction in Colombia took a large portion of formal-sector housing finance out of the control of a semi-governmental organization (BCH), and placed it in the hands of newly-created Corporaciones de Ahorro y Vivienda (CAVs, the equivalent of savings and loans), which were affiliated with private banks. By the early 1980s, the UPAC system was capturing approximately one-fourth of all voluntary savings in Colombia, and providing 70 percent of all the financing for private, formal-sector housing (Jaramillo, 1982).

Proponents of UPAC argue that the system has played an important role in stimulating the construction industry in Colombia. From 1972, the year when UPAC was begun, until 1982, the last year of the Betancur administration, the proportion of Gross Domestic Product represented by construction increased from 4.02 percent to 5.16 percent (Colombia, DANE, 1985). The total number of housing units financed by the government entities BCH, ICT, and FNA remained fairly stable at around 30,000-35,000 per year. However, the CAVs started from a base of zero, to become the top source of financing for middle-income households. By the late 1980s, the CAVs were financing in the range of 35,000-55,000 housing units annually at the national level (Giraldo Isaza, 1987). The net result was a significant increase in legal housing construction.

Villamizar (1982) argues that by stimulating construction, UPAC exerted upward pressure on land prices in Bogotá. His index shows that after being fairly stagnant during the 1960s, overall land prices in the Colombian capital increased 13 percent in real terms from 1972 to 1973, the first year of UPAC. Our own index, using the unweighted average of all land prices for a particular year, shows a 20 percent gain during 1972-73 (Table 15 and accompanying text). Recall that the unweighted index may give a better picture of the actual activity in the land market, than the comuna averages weighted by their land area. While Villamizar's weighted average shows large increases in land prices in the late 1970s, our own calculations show stagnation and even decline. With our formulation, the period 1972-73 stands out as one with very substantial land price increases. Our tentative conclusion is thus that the introduction of UPAC did exert upward pressure on Bogotá's land prices.

While increased land prices can often be considered a benefit rather than a cost, the transfer of housing finance to the private sector has had some more clearly negative effects. Two especially serious consequences stand out. First, the state temporarily lost its ability to direct the flow of credit to particular socioeconomic groups. Second, the UPAC system gave rise to giant financial networks which have extended their reach into both the building materials sector and the construction industry, and which have been embroiled in serious scandals involving misuse of funds (Robledo, 1985; Jaramillo, 1982).

The government has had a two-pronged response to the crisis in financing for less well-off groups. First, it has mandated that specified minimum percentages of CAV funds be destined for more affordable housing. Second, the state has come to accept modified forms of self-help housing, including the controversial "sites and services" approach, as substitutes for direct financing of dwelling units for the poor (Jaramillo, 1982). A recently approved package of legislation referred to as "urban reform" continues the mandate that 25 percent of UPAC lending go to "social interest" (what in the U.S. would be called "affordable") housing. This is defined as housing costing less than 4.4 million pesos, around $12,000 U.S., as of May 1989. There is confusion over whether or not the new regulations permit indexed loans for this type of housing ("Hoy se definen primeros cambios...," El Tiempo, 1989).

Crises in housing finance are by no means unique to Colombia. Their principal manifestation is through the shelter crisis for the poor, for whom existing credit schemes are one more reason why they are priced out of formal-sector

housing. However, credit constraints also affect middle-income households, and can fundamentally alter the pattern of housing production. For example, in Brazil the requirement that the Banco Nacional de Habitaçao devote a significant proportion of its resources to lower-cost housing units, at one point, led to a glut of more costly apartments in central-city areas of Sao Paulo. Entire buildings stood empty, largely because of a lack of buyer financing. What did sell were cheaper units at the periphery, for which credit was available ("A luta da casa própia," 1982).

The ICT and its Role in Housing Finance and Production

Even when obligated to provide funds for low-income housing, the Corporaciones de Ahorro y Vivienda have not offered truly affordable financing terms. The "low-cost" units available are usually at the upper limit for "affordable" housing. For example, under President Betancur the CAVs were obligated to invest at least 25 percent of their portfolio in housing valued at 1,000 UPACs or less. Devoting 30 percent of their income to the monthly payments, the proportion of households in Barranquilla that could not afford a 1000 UPAC dwelling was 36 percent in 1982, 46 percent in 1984, and 58 percent in 1985 (Giraldo Isaza, 1987).

As noted earlier, the Instituto de Credito Territorial was established in 1939 as an entity devoted to rural housing. In 1942, an urban section was created within the Instituto, and in 1956 the provision of dwellings in rural areas became the responsibility of a new agency, the Caja de Credito Agrario.

The ICT operated on a very small scale until the 1960s. Between 1942 and 1957 it constructed a total of only 18,178 urban housing units, little more than 1,000 per year. This situation changed radically with the impulse given to housing, particularly low-income housing, by the Alliance for Progress. ICT production for the three-year period 1960-62 reached 60,999 dwelling units. Not until the 1970s would annual production again reach 20,000. The ICT received a strong boost from President Betancur: its production soared to 80,000 housing units during the period 1983-84 (Giraldo Isaza, 1987).

The above figures exaggerate somewhat the role of the ICT in housing supply, as the Instituto itself does not actually build the units. It is involved in the other aspects of the development process, especially finance and land acquisition. The ICT gathers funds from a variety of sources, including the

national government budget and both mandatory and voluntary deposits from other financial institutions. The ICT tends to acquire low-cost peripheral land for its subdivisions, with all the problems of service provision that this implies. The Instituto appropriates much of the increased value of the land once it is graded and serviced. The lots are sold to clients for far more than the ICT pays for them, at the same time that there are additional charges made for infrastructure provision and grading (Robledo, 1985).

The ICT supports two types of residential construction: projects contracted out to private builders, and self-help housing. Many complaints have been registered concerning the quality of ICT-contracted housing. In addition, the projects are usually not directed to the very poorest households, and some of the more "successful" developments, such as Centro Nariño in Bogotá, are solidly middle-class.

Self-help housing became a part of the ICT's activity with the establishment of the Programa de Ayuda Mutua Dirigida (Program of Directed Mutual Help) in 1959, and the Programa de Casas Inconclusas (Program of Unfinished Houses, i.e., progressive construction). The surge in ICT construction during the following years took place largely within the context of these two programs: over 70 percent of all ICT units built between 1958 and 1962 had a self-help component (Robledo, 1985). Even opponents of the self-help concept tend to agree that the Instituto's most famous self-help project, Ciudad Kennedy in Bogotá, has been a resounding success.

Other Sources of Housing Finance in Bogotá

The BCH, ICT, and CAVs are responsible for the great majority of licensed residential construction in Colombia. However, in Bogotá there are three additional savings funds which play an important role in housing finance. These are the Military Housing Fund (Caja de Vivienda Militar--CVM), the Popular Housing Fund (Caja de Vivienda Popular-CVP), and the National Savings Fund (Fondo Nacional de Ahorro--FNA).

The CVP is a municipal fund which operates only in Bogotá, and is at present concentrating its resources on sites and services programs in Ciudad Bolivar. As part of its Subprogram 3, the CVP is transforming two large parcels of land that it owns into 10,600 lots. The Caja will then offer credits for progressive development (i.e., self-built housing) on this land (CAMACOL, 1989).

The Caja de Vivienda Militar (CVM) finances housing for its affiliates (military personnel and their dependents), and has concentrated its efforts in Bogotá. In 1988, the CVM financed the construction of 1,652 housing units, with the average value per unit varying with the rank of the intended recipient. As of early 1989, the CVM had plans to devote 89 percent of that year's budget to projects in Bogotá totalling 1,342 units (CAMACOL, 1989).

The Fondo Nacional de Ahorro (FNA) is a savings institution whose affiliates are federal government employees. The FNA is in charge of making severance payments to public employees when they leave government service. This entity also finances housing for its affiliates, using funds from payroll deductions, voluntary deposits, investment income, and federal contributions. In 1988, the FNA provided over 15 billion pesos (roughly $50 million US) of credit for housing. This included credit for the construction of specific projects, as well as direct loans to affiliates for the purchase of housing. The FNA financed a total of 6,666 dwellings in 1988, 42 percent of them (2,815) in Bogotá (CAMACOL, 1989).

The Components of the Cost of Housing

Robledo's calculations (Table 29), based on data from the Colombian developers' association CAMACOL, are a useful starting point for a discussion of formal-sector housing costs in Colombia. The data cover the period from 1972 until 1982, and are for both single- and multi-family units.

There are two very striking things about the data in Table 29. First, the share of land costs in the total cost of single-family housing increased dramatically between 1972 and 1982, from 12 to 20 percent. This figure by itself lends credence to the view that high land prices have been a key factor behind the shift to multifamily housing in Colombian cities. This paper has raised doubts as to whether <u>overall</u> land prices in Bogotá have risen by a large proportion. However, many individual neighborhoods have experienced substantial increases (see Table 16 and accompanying text).

According to the data presented by Robledo, the share of land costs in total construction costs for multifamily housing actually declined between 1972 and 1982, from 17 to 15 percent. This result is consistent with a land-capital substitution elasticity greater than unity, i.e. a more-than-proportional response of the capital/land ratio to changes in land prices. However, we suspect that in his calculations, Robledo has not controlled for the size of

Table 29

Components of the Cost of Housing in Colombia, 1972-1982
(percent)

Component of Costs	1972		1974		1978		1982	
	Single-Family	Multi-Family	Single-Family	Multi-Family	Single-Family	Multi-Family	Single-Family	Multi-Family
Land	12	17	15	16	17	15	20	15
Direct costs	59	50	58	50	51	50	43	48
Taxes & permits	6	7	6	8	5	7	6	6
Financial costs	8	7	9	10	12	14	19	19
General & administrative costs	15	17	12	16	14	14	12	12
TOTAL	100	100	100	100	100	100	100	100

SOURCE: Robledo, 1985. Based on data from CAMACOL.

the housing unit. The declining share of land costs results most likely from a shift to both higher construction quality and a smaller dwelling size.

A more recent paper published by CAMACOL (1987) develops a typology of formal-sector residential construction, and estimates a per-square-meter building cost. Table 30 shows the typical characteristics and an average cost for five classes of multi-family and four classes of single-family housing. It is interesting to note that the difference in estimated structure costs of single-family and multi-family dwellings is not great; in no case does it exceed 15 percent for housing units designed for the same income class. The implication is that a considerable portion of any observed differences in the price per square meter must be attributed to variations in the price of land.

The second important trend in housing costs is the growing share of finance (i.e., credit) costs in the total. In 1972, when the UPAC system was introduced, financial costs represented 8 and 7 percent, respectively, of the total cost of new single-family and multi-family dwellings. Ten years later, the share for both types of housing had risen to 19 percent. It is wrong to place the blame for escalating credit costs on the concept of indexing itself. The problem is rather that the concentration in credit markets and the building industry, combined with persistent shortages of loanable funds, has occurred simultaneously with the development of the UPAC system. As Robledo (1985) points out, even though there is a limit to the interest rate that the CAVs can charge for UPAC loans, this has not kept them from extracting additional (illegal) fees from borrowers.

Trends in Housing Affordability

How has the affordability of housing in Bogotá changed over time? The realtors' association, FEDELONJAS, has developed the following indices for formal-sector dwellings:

	Index of real value of middle-income housing relative to CPI	Index of real value relative to construction costs
December 1978	100.0	100.0
December 1987	151.78	137.49
August 1988	147.74	131.47

Table 30

Characteristics and Average Construction Costs
for Nine Types of New Housing in Bogotà

Type of Housing Unit	Representative Characteristics: Number of Floors	Area in Square Meters	Number of Bedrooms	Average Construc. cost/m2 (1987 Col. pesos)
Single-Family				
1. Low-income	1-2	30-50	1	$16,837
2. Lower-middle-income	2	50-65	1-2	22,307
3. Middle-middle-income	2	80-90	3	30,126
4. Upper-middle-income	2	100-180	3-5	38,620
Multi-Family				
5. Low-income	5	50	1	$17,840
6. Lower-middle-income	5	50-65	1-2	23,688
7. Middle-middle-income	5	70-95	3	34,675
8. Upper-middle-income	5-7	120-160	3-4	43,591
9. Upper-income	up to 10	120-380	3-5	51,577

Other typical characteristics of housing types:

1. 1 bathroom, washbasin for clothes, interior patio.
2. 1 bathroom, washbasin for clothes, interior patio.
3. 2 bathrooms, washbasin for clothes, interior patio, uncovered parking space, built-in kitchen.
4. 3-4 bathrooms, washbasin for clothes, interior patio, garden, covered parking space, built-in kitchen.
5. 1 bathroom, washbasin for clothes
6. 1 bathroom, washbasin for clothes
7. 1-3 bathrooms, washbasin for clothes, parking, intercom, communal television antenna.
8. 2-4 bathrooms, garbage chute, satellite dish for television, intercom.
9. 3-6 bathrooms, waiting area, garbage chute, electric dishwasher, parking garage, intercom, garden

SOURCE: CAMACOL, 1987.

SOURCE: FEDELONJAS, 1988.

The implication of the above numbers is that housing prices have risen substantially in real terms, and have increased considerably faster than construction costs. During the period 1978-1988, the real minimum wage (i.e., deflated by the CPI) increased by less than 20 percent. Our tentative conclusion is that housing prices now represent a greater burden on households than ten years ago.

One strategy used to mitigate the effects of higher housing prices is of course to consume fewer housing services. In part because of smaller household size, but probably also because of affordability considerations, the average size of dwelling units in Bogotá has been declining. Any analysis of average housing prices which fails to take into account the decrease in size will tend to underestimate the degree to which housing prices have increased. Data from the architectural supplement Habitar are revealing on this point. A February 1986 survey of new housing in the north and west of Bogotá reported average prices of between 40,000 and 50,000 pesos per square meter of floorspace. A similar August 1989 survey for the same area of the city reported prices of between 120,000 and 160,000 pesos per square meter. The CPI had increased only about 2.32 times during this period, indicating a substantial increase in real housing prices. At the same time, annual income increases had only been a little ahead of inflation. The implication is that the reduction in dwelling unit size has been an important way for households to keep down their housing costs. This is the same strategy that Molina (1989) has found among low-income households of Bogotá.

As we have shown elsewhere in this paper, households in Bogotá which are in the lower half of the income distribution are mostly excluded from formal-sector housing. As an illustrative example, let us consider the cases of Villa del Cerro and Aurora II, housing developments in south Bogotá. These subdivisions represent the lowest-cost formal-sector dwellings in the city. In February 1987, a Villa del Cerro apartment with 52 square meters of floorspace (2 BR, 1 BA) began at 1.55 million pesos, at that time equivalent to $6,828 US. The Aurora II duplex had only 32.45 square meters, one bedroom (with the possibility of additions), and one bath. This unit cost 1.3 million pesos, or $5,727 US. Villa del Cerro buyers needed an income of between 2.5 and 3.0 minimum salaries to qualify, while Aurora II purchasers needed an income of at least 2.2 minimum

salaries. This, when in 1985 almost half (47.4 percent) of Bogotá's households earned 2.5 minimum salaries or less.

Barring dramatic increases in the real incomes of the poor, it will be difficult for formal-sector building to make inroads among lower-income groups without subsidies to either producers or consumers. Two intermediate housing solutions (i.e., between "formal" and "informal") which hold some promise for solving the shelter crisis are: (1) continued work on less-expensive building techniques, and (2) "cooperative self-built" housing. The latter combines modern construction techniques (including substantial use of prefabricated building materials), with contributions of labor from the individuals who will later occupy the units.

Conclusions: Land Markets and the Supply of Housing

This paper ends on an uncertain note. In our overview of land and housing markets in Bogotá, we have attempted to avoid extremes of optimism or pessimism. In its favor, the city has its relatively manageable size (still under five million), a moderate annual growth rate (2.6 percent), and an extensive network of basic infrastructure. Nevertheless, there is evidence (e.g., newspaper real estate listings) which suggests that, in the latter half of the 1980s, housing prices in the "formal" sector have increased at a rate significantly above the inflation rate. If this is indeed the case, it is reasonable to expect that a similar trend is filtering down to low-income housing. The housing affordability crisis for the poor is symptomatic of a larger problem. As Gilbert and Ward (1985) concluded:

> What is worrying is that there are few consistent signs that welfare levels among the poor are improving, even though the city's economy has been expanding rapidly. [p. 47]

For now we prefer to reserve judgement on the role of land prices in driving up the cost of housing in Bogotá. The World Bank's very extensive data set does not support the conclusion that there have been large real increases in land prices in the Colombian capital, and, in fact, a simple average of the observations in the data set gives an annual decline in real terms of 1.4 percent. It is nevertheless common to find assertions such as the one made in 1982 by the Director of CENAC, a builders' organization which researches housing

issues. At the Seminar on Housing at the National University of Colombia, Dr. Oscar Gómez claimed that land prices in Cali and Bogotá had been increasing during the previous decade at an annual rate of 40 percent (Suárez, 1984). The discrepancy with the World Bank data would be partly explained if Gómez were referring to nominal rather than real land prices, or if the CENAC study weighed peripheral locations more heavily than sites within the urbanized core.

Policies which affect the supply (and therefore the price) of land are only a partial answer to the shelter crisis. Building materials and credit are also important components of the total cost of housing. In addition, as other writers have noted, the housing problem for the poor in developing countries is in many ways fundamentally an income problem. Efforts to lower housing production costs within the framework of a market economy may not be enough to make formal-sector shelter truly affordable to the poor. In the absence of sustained increases in household income, or policies to supplement the wage earnings of the poor, the remaining options are self-built housing and massive state intervention to produce low-cost (probably subsidized) dwellings on a large scale. Despite considerable dissatisfaction with the results, in Colombia the autoconstrucción solution remains the norm.

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