Rakesh Mohan and Rodrigo Villamizar

The Evolution of Land Values in the Context of Rapid Urban Growth
A Case Study of Bogotá and Cali, Colombia


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A Simple Model of Urban Land Values

That land policy is an important component in the process of public policymaking is evident. One of the key ideas resulting from the United Nations Conference on Human Settlements when it met in Vancouver in 1976 was embodied in the preamble to the recommendations for national action on land: “Land, because of its unique nature and the crucial role it plays in human settlements, cannot be treated as an ordinary asset controlled by individuals and subject to the pressures and inefficiencies of the market” (Lichfield 1980). It is ironic, then, that our knowledge of the actual operation of urban land markets and of the resulting land values is highly limited. Pronouncements on the desirability of, and on the contents of, urban land policy are easy to find; facts on which these policies are based are, however, distinguished by their absence.

Our objective in this paper is to present a somewhat detailed case study of what has happened to land values in two Colombian cities during a period of extremely rapid growth when both the cities have roughly doubled their size. We believe that only when we can understand the role of land values in the urban economy and of their relationship with, and effect on, the evolving urban structure of cities during periods of rapid growth, can we begin to enunciate policies that ultimately enhance public welfare.

Much of the concern with the operation of land markets arises from the observation of rising land values that are seen as unwarranted or undesirable. Second, when land values do rise rapidly, certain lucky individuals who own land are seen to reap large windfall gains, which they have done little to earn. Such anxiety is understandable since land is a major component of the production of housing—which everyone needs—and of...
urban production facilities—on which everyone depends for their livelihood. Windfall gains or large gains are usually associated with aspects of monopoly power, and thus there is a general suspicion that urban land markets are characterized by monopolistic arrangements. An understanding of the operation of urban land markets and their relationship with urban growth would, however, reveal that these land-value increments must necessarily occur along with urban growth and more in certain parts of the city than in others. Thus, even when there is no monopoly in landownership, windfall gains would accrue to individuals who happen to own land in those parts. The latter is more an income-distribution issue than a land-policy issue.

Before presenting the empirical information on land values in Bogotá and Cali, we develop a highly simplified but useful model of land values, which will serve to put in perspective the patterns observed. Gregory Ingram has already presented a paper in this conference that places land in the context of conventional economic theory. We continue in a similar vein but pay more attention to the role of land values in ordering the internal structure of a city. The model we developed is highly simplified and might appear to belabor the obvious. Its results, however, are surprisingly powerful and help us understand the patterns we then observe.

Urban land is demanded as an asset in two ways. It is, first, a factor of production in the production of housing, factories, or public services (such as roads and parks), when returns to it come in the form of housing services or income from the produced goods. It is also demanded as what might be termed a pure asset in people’s portfolios. Developed land is used as both: it usually forms the major portion of a family’s assets, as well as a factor of production in housing. Undeveloped land, however, is mainly used as a pure asset. “The function of land prices is to allocate land to valuable uses” (Mills and Song 1979, p. 99). Thus, high land prices indicate scarcity, and the use of land is economized. This can also be stated conversely: when land is scarce, its price is high and its use is consequently economized. As with the prices of other goods, the price of land is important as a signal for the rational allocation of its use.

From what does land derive its value? In agricultural uses it is easy to understand that an acre of more-fertile land produces more food and is therefore more valuable as compared with an acre of less-fertile land. In the urban context it is clearly not fertility that gives land its value, but we can stretch the agricultural analogy to obtain an understanding of the value of urban land. If we consider a city surrounded by agricultural land of equal fertility that produces the food consumed in the city, will the land be uniformly valuable regardless of the distance from the city? Probably not. We can expect the price of food in the city to be the same regardless of its origin. If all the land is equally fertile we can expect all other inputs
Case Study of Bogotá and Cali

to cost the same per acre regardless of the distance from the city. The farmers farther from the city, however, have to spend more on transportation per ton of food than those nearer the city. All farmers will therefore want to locate nearer the city and will consequently bid up the value of land near the city. We will observe what might be called a land-value gradient, with land values declining with distance from the city. We can now drop our unrealistic assumption of equal fertility. More-fertile land will be more valuable than less-fertile land at the same distance; land nearer other amenities such as water sources will be more valuable as well. We now have a simple model of the value of agricultural land:

\[ V_L = (\text{distance, fertility, other amenities}) \]

where \( V_L \) is the value of land per unit area. By employing minor changes in terminology, we have a model of urban land values. If we regard distance as a measure of access characteristics, fertility as merely use of site-specific characteristics, and rewrite amenities as neighborhood qualities, we can now write,

\[ V_L = (\text{access characteristics, neighborhood qualities, site-specific characteristics}) \]

and we have a plausible model of urban land values. To revert to agricultural land once more, when the city expands, land near the city is converted to urban use, and distance from the edge of the city decreases for all the remaining land. We can therefore expect the value of each plot to rise. The access of each plot improves, and therefore its value rises as well. Much the same thing happens within the city as the city grows and access of plots improves.

People congregate in a city in order to take advantage of improved employment opportunities provided as a result of the concentration of a variety of activities that arise because of a concentration of people. The argument is somewhat circular but does capture the essence of cities. In general, economic activities are concentrated in or near the center of a city (we can even define the center of a city as that part of the city that has a concentration of activities). Measures of the concentration of activities include density of employment and density of residential population. Characteristically, employment densities are highest in the center of cities and decline with distance from the city center. Thus, access characteristics of land also decline with distance from the city center. If all employment in a city is in the center, access characteristics will obviously decline with distance from the city center. This is not an unrealistic representation of small cities, where almost all of the commercial economic activity is located in the city center.
As a city grows, the access characteristics of its center decline on account of increasing average distances from the city center of the residential population. Thus, commercial economic activity springs up in all parts of the city, and access characteristics of neighborhoods distant from the city center improve. Consequently we can expect residential densities, as well as land values, to increase in all parts of the city. This phenomenon is not very different from the effects of an expanding city in agricultural land values. From this simple, plausible model of land values we therefore have a number of strong results:

First, land values, population densities, and employment densities can be expected to decline with distance from the city center. Indeed, more-rigorous economic models suggest an exponential decline of these quantities from the city center. 

Second, an expanding or growing city will result in the rise of land values and densities all over the city, with perhaps a proportionally smaller increase in the center because of its hypothesized relative loss in access characteristics. If the pattern of decline from the city center is exponential, we would then expect the curve to rotate somewhat, as shown in figure 14-1. If \( V_0 \) is the value of land at the center of the city, \( V_A \) represents the land-value pattern at an initial time period and \( V_B \) when the city has expanded outward to \( B \) later. We are assuming here that \( V_0 \) has remained constant. The slope of such a curve, or the percentage decline in land values or densities per unit distance, is a convenient summary measure describing the structure of the city. The smaller the slope of a density gradient, the smaller the proportion of people residing within a given distance of the city center. The decrease in this slope is often referred to as a measure of decentralization.

Third, with a declining slope and nondecreasing \( V_\phi \), we can therefore expect a growing city to have secularly rising average land values.

![Figure 14-1. Pattern of Land Values in a Growing City (1)](image-url)
Fourth, we have suggested that as a city grows, we can expect the concentration of economic activity to decrease in the center and that subcenters would develop in other parts of the city. Where these subcenters develop, because of their relatively better access characteristics (as compared with other land at the same distance from the city center), we would expect relatively higher land values. A land-value surface in a growing city therefore can be expected to change from a smooth, conical-type surface to one with ridges, valleys, and small hills.

Fifth, until now we have concentrated on the access characteristics while ignoring the other determinants of land values: neighborhood qualities and intrinsic quality of the land. In the intrinsic quality of land or site-specific characteristics, we include the level and quality of infrastructure provision and the geography of the site (for example, whether it is level, sloping, or uneven). At similar access levels, we would expect land with higher intrinsic quality to be more valuable. Neighborhood qualities are essentially externalities—positive or negative. Examples of positive externalities are the availability of good views, good neighbors, and good roads. Negative externalities include noise and air pollution.

A simple view of urban structure and land has yielded a relatively sophisticated model of the determination of urban land values. Note that I have spoken only of urban land values, not prices. Our observations so far are therefore system free. We may choose to adopt whatever price system we like in conformance with a society's preferences, but to the extent that we regard value as the opportunity cost of using a commodity, the conjectures or hypotheses of land-value patterns are general. Consequently if price is determined in a market system, we can use conformance to these patterns as one indication of the efficient functioning of the market. In a market system the price of land at time \( t \) is the discounted sum of expected returns from holding it in the future. Specifically:

\[
P_o = \sum_{t = 0}^{\infty} \frac{R_t}{(1 + r)^t}
\]

where \( P_o \) is the price of land at time \( o \), \( R_t \) is the return from it at time \( t \), and \( r \) is the discount rate. Thus, the price of land today depends on the return we expect from it tomorrow. This gives another clue as to why land prices can be expected to rise with rapid urban growth. Land values, or opportunity costs, tend to rise in a growing city. In addition, as people come to expect these increases, they will tend to capitalize them today with the expectation of higher returns tomorrow. Thus, we get our sixth result: land prices can be expected to lead urban growth; that is, prices increase before the opportunity cost of the land increases.
Until now we have mainly talked about the price or value of specific parcels of land. What do we mean when we say that the price of land has increased in general? Such a statement is difficult to interpret. The observed price of any commodity is essentially a distribution around some mean, and it is, in general, not too difficult to find the mean. If a market does not contain significant distortions, the variance in observed prices is small. Thus, a statement concerning the trend of apple prices, for example, is relatively unambiguous. The key idea is that the good is homogeneous, and we can then talk about its price. As we have seen, urban land derives its value largely from its location (access characteristics and neighborhood qualities), and the value of one parcel can be different from another by an order of magnitude. An extreme view would be that each plot of land is unique and land is therefore not a homogeneous commodity whose average price we can easily discuss. Nonetheless, it is clear that if a growing city causes the land-value pattern to change from $V_A$ to $V_B$ in figure 14-1, we can say unambiguously that land values have increased in the city. If, however, the change is as in figure 14-2, $V_A$ changes to $V_B$ as the city expands, land values in the city center have declined and increased near the periphery. Now we cannot make an unambiguous statement about increasing land values in the city. Even the aggregate land values for the whole city are not very informative since the land area has also changed. Thus we need to be careful in making statements about changes in average land value in the context of rapidly expanding cities.

Changing Structure of Urban Land Values and Population Densities

Both Bogotá and Cali have grown at remarkable rates of growth for an extended length of time. Bogotá has expanded more than eightyfold over the
last hundred years and Cali fiftyfold to sixtyfold during the same period. More importantly, they have both grown five to six times in the post-World War II period alone. Table 14-1 summarizes the growth of these cities since 1800. In comparison, in another fast-urbanizing country, South Korea, its two largest cities, Seoul and Busan, have also grown by similar magnitudes. Growth in Colombian cities was most rapid in the 1950s and 1960s and has since slowed.

Like land values, overall population densities depend crucially on the definition of a city's boundaries. According to available sources, it appears that the area of Bogotá City has been successfully redefined along with its growth, with the surprising result that overall density has remained roughly constant at 100 to 110 persons per hectare. Furthermore, according to current definition of the boundaries of Cali, the population density of Cali is also very similar. In comparison, the central cities of New York (covering the boroughs of Manhattan, Bronx, Brooklyn, and Queens) and Tokyo (each about 8 million to 9 million people) have densities of about 110 and 150 persons per hectare (Mills and Ohta 1976, p. 685); Chicago and Philadelphia about 60; central Buenos Aires 150 and central Mexico City 210 (central areas covering about 3 million people in each city); and Calcutta and Bombay about 120 to 140 (Mohan 1979). Except for Bombay and Calcutta, these comparisons are for central cities. Probably Bogotá is more densely populated than comparable Latin American cities if similar definitions are used but less so in the central city. It is of interest that its density is not very different from New York City (excluding Staten Island).

The structure of the two cities has changed with this rapid growth. Table 14-2 presents information on changing population densities by ring in the two cities from 1964 to 1978. (See figures 14-3 and 14-4). Ring 1 is the central business district (CBD). Both cities are semicircular in shape, with mountains constraining growth in the other half of the circle. Thus each

---

**Table 14-1**

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (hectares)</th>
<th>Population</th>
<th>Growth Rate (% per year)</th>
<th>Density (persons per hectare)</th>
<th>Population</th>
<th>Growth Rate (% per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>n.a.</td>
<td>22,000</td>
<td></td>
<td></td>
<td>6,000</td>
<td>1.4</td>
</tr>
<tr>
<td>1900</td>
<td>909</td>
<td>100,000</td>
<td>1.5</td>
<td>110</td>
<td>24,000</td>
<td>1.4</td>
</tr>
<tr>
<td>1938</td>
<td>2,514</td>
<td>330,000</td>
<td>3.2</td>
<td>131</td>
<td>88,000</td>
<td>3.5</td>
</tr>
<tr>
<td>1951</td>
<td>n.a.</td>
<td>660,000</td>
<td>5.5</td>
<td>n.a.</td>
<td>284,000</td>
<td>9.0</td>
</tr>
<tr>
<td>1964</td>
<td>14,615</td>
<td>1,730,000</td>
<td>7.4</td>
<td>118</td>
<td>638,000</td>
<td>6.3</td>
</tr>
<tr>
<td>1973</td>
<td>30,423</td>
<td>2,877,000</td>
<td>5.8</td>
<td>95</td>
<td>930,000</td>
<td>4.2</td>
</tr>
<tr>
<td>1978</td>
<td>30,886</td>
<td>3,500,000</td>
<td>4.0</td>
<td>113</td>
<td>1,100,000</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: Mohan (1979); Tabares (1979).
Table 14-2


(persons per hectare)

<table>
<thead>
<tr>
<th>Area (100 hectares)</th>
<th>Bogotá</th>
<th>Cali</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring 1 (CBD)</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Ring 2</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>Ring 3</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Ring 4</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Ring 5</td>
<td>140</td>
<td>25</td>
</tr>
<tr>
<td>Ring 6</td>
<td>117</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>305</td>
<td>50a</td>
</tr>
</tbody>
</table>

Source: Mohan (1979); Pachón (1980); Tabares (1979).

Note: All figures rounded.
aCity area has been kept constant for all these calculations. In fact both cities grew during the period in question, and many peripheral areas included here were outside the city boundaries in 1964.

ring is semicircular. The maximum distance from the city center is about 15 kilometers (to ring 6) in Bogotá and about 10 kilometers (to ring 5) in Cali. Various features of these patterns are worth noting. First is the remarkable similarity in structure of the two cities. Growth has clearly occurred by accretion in the outer rings. The density in the CBD has tended to decline somewhat from about 200 persons per hectare. The growth has occurred on the fringes of the existing cities, along with densification of the inner rings. This process is somewhat different from the growth pattern observed in most U.S. cities as they grew in the early 1900s. "Quantum changes in the technology of urban transit imply not only a layering of incrementally lower density rings in the industrial metropolis, but also sharply lower aggregate densities in entire urban areas, the main growth of which came after 1920—in the auto age" (Norton 1979, p. 69). Thus while Bogotá and Cali have also decentralized with growth in the sense that a smaller proportion of the total population lives in any area of constant radius, they have not decentralized like many U.S. cities, where central cities have actually lost populations in absolute terms. This pattern of accretion has been very much in accordance with our hypothetical conjectures.

What has happened to land values during the same period? Good land-value data are notoriously difficult to obtain. One of the problems is that it is difficult to separate the value of land from the structure built on it. Most transactions observed in built-up cities are, however, of plots with buildings on them. We have been fortunate in obtaining a unique data set of about six thousand transactions in Bogotá covering the period 1955 to 1978 from the files of the long-established real estate firm of Wiesner and Cia Ltd. Guillermo Wiesner has kept meticulous records for almost forty years because
Figure 14-3. Bogotá Ring System
Figure 14-4. Cali Ring System
of his own interest in land valuation. We were able to choose the vacant-land-only transactions and therefore did not have to separate land values from built-up property values. This data set contains more transactions near the city center in earlier years and fewer in later years; the converse is the case for the outer rings. We have confidence in the overall quality of the data except that the land values in the CBD might be on the low side in the later years. There is little vacant land left in the center of the city; it may be that the last vacant plots being transacted have other quality problems and are therefore not representative of the CBD land values.

The data set for Cali, obtained from the Cali Municipal Planning Office, is probably of less-consistent quality since the methods of collection were different. The office has kept files on land value averages for each barrio or neighborhood. In 1964 there were 84 such observations and in 1978-1979 about 170. These neighborhood averages were based on direct observation, as well as interviews with local real estate agents. The compilation has been done by different individuals over this time period. We do not know the averaging procedure used within the barrio. Nonetheless, the overall patterns are clear, and we now turn to table 14-3, which gives a summary of the evolving land price surfaces for Bogotá and Cali from 1964 to 1978. The prices are given in constant 1978 Colombian pesos; earlier nominal values have been converted to 1978 prices by using the consumer price index. The overall pattern is that there is relative stagnation of land prices near the center and higher rates of price increases near the periphery. This is quite consistent with the evolution of density patterns. There are, however, some surprises. The Bogotá data indicate an actual decline of land prices in and near the CBD in real terms. This may be because of data problems. Nonetheless, it is clear that land prices have not risen appreciably in real terms in the center of Bogotá. The trends are better seen in figure 14-5, which shows a land price index for each ring from 1955 to 1977 in comparison with the consumer price index. Land prices have essentially risen along with the consumer price index in rings 1 to 3 and ahead of it in rings 4, 5, and 6.

The picture for Cali is broadly similar but with some differences. First, the magnitude of Cali land prices is similar to that in Bogotá. Indeed, the CBD prices seem somewhat higher in Cali than in Bogotá. Accounting for data problems, we can at least conjecture that they are unlikely to be less than in Bogotá. Their growth rates do seem to be somewhat higher. That their magnitudes are now somewhat similar is consistent with their densities being similar. Mills and Song (1979) also found for South Korea that the growth in land values in the three largest cities was less than in the next nine largest. Thus, it is safe to conclude that the growth of land values is not higher in larger cities.

At this point, we need to recall the hypotheses suggested by our simple land-value model. (1) Land values and population densities do decline from
Table 14-3
Evolution of Land Values by Rings, Bogotá and Cali, 1964-1978
(1978 Colombia pesos per square meter)

<table>
<thead>
<tr>
<th>Ring</th>
<th>Average Distance from CBD (km.)</th>
<th>1963-1965</th>
<th>1972-1974</th>
<th>1975-1977</th>
<th>Growth Rate 1964-1978 (% per year)</th>
<th>Average Distance from CBD (km.)</th>
<th>1963</th>
<th>1974</th>
<th>1979</th>
<th>Growth Rate 1963-1979 (% per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4,250</td>
<td>3,900</td>
<td>3,100</td>
<td>-2.3</td>
<td>0</td>
<td>5,900</td>
<td>4,600</td>
<td>6,400</td>
<td>0.6</td>
<td>5,900</td>
</tr>
<tr>
<td>2</td>
<td>1,850</td>
<td>1,660</td>
<td>1,550</td>
<td>-1.3</td>
<td>1.8</td>
<td>1,100</td>
<td>1,100</td>
<td>2,400</td>
<td>5.6</td>
<td>1,100</td>
</tr>
<tr>
<td>3</td>
<td>1,350</td>
<td>1,350</td>
<td>1,320</td>
<td>-0.2</td>
<td>3.4</td>
<td>520</td>
<td>480</td>
<td>1,030</td>
<td>4.9</td>
<td>520</td>
</tr>
<tr>
<td>4</td>
<td>870</td>
<td>1,080</td>
<td>1,130</td>
<td>1.9</td>
<td>5.4</td>
<td>380</td>
<td>410</td>
<td>960</td>
<td>6.6</td>
<td>380</td>
</tr>
<tr>
<td>5</td>
<td>570</td>
<td>800</td>
<td>850</td>
<td>2.9</td>
<td>6.9</td>
<td>150</td>
<td>370</td>
<td>810</td>
<td>12.0</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>370</td>
<td>700</td>
<td>730</td>
<td>4.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Case Study of Bogotá and Cali


**Figure 14-5.** Land Price Indexes in Bogotá
the city center in Bogotá and Cali. (2) Land values and densities increase all over the two cities along with urban growth, but proportionately less so in the center. (3) Bogotá and Cali do have rising average land values; in Bogotá they have growth at about 3 to 4 percent per year in real terms since 1955. Recall, however, the caution with which average land values should be interpreted. To reemphasize this point, we can say with confidence that land prices have increased in real terms on the periphery, but at best, they have remained constant in the center.

We now measure the changes in land-value and density patterns more systematically by measuring the changes in density and land-value gradients. We can express the two patterns by simple exponential equations:

\[ D_x = D_o e^{-gx} \]  
\[ V_x = V_o e^{-hx} \]

where \( D_x \) is the population density at \( x \) kilometers from the center, \( V_x \) is the land value \( x \) kilometers, and \( D_o, V_o, g \) and \( h \) are the parameters to be estimated from the data. In fact \( D_o \) and \( V_o \) estimate the density and land value at the center (when \( x = 0, D_x = D_o e^{-0} = D_o \)); and \( g \) and \( h \) estimate the two gradients that can be interpreted as the percentage decrease in density and land values, respectively, per kilometer. Tables 14-4 and 14-5 present the results of these calculations.

First consider table 14-4, which gives the density gradients for Bogotá and Cali for 1964, 1973, and 1978. The unit of observation is the barrio or neighborhood. The table shows that \( g \) declines over time as expected for both the cities and is higher for Cali than for Bogotá. For purposes of comparison, in 1970 \( g \) was \(-0.08\) for New York, about \(-0.13\) for Atlanta, \(-0.22\) for Seoul, \(-0.17\) for Mexico City, \(-0.12\) for Buenos Aires, and \(-0.08\) for Tokyo (Ingram and Carroll 1981; Mills and Tan 1978). Thus Bogotá has a gradient similar to other large cities. Among smaller cities like Cali we have information for Monterrey, \(-0.27\), and Guadalajara \(-0.41\) (Mexico); Belo Horizonte, \(-0.27\), and Recife, \(-0.17\) (Brazil); Sapporo, \(-0.23\) (Japan); and Busan, \(-0.13\) (South Korea). We may conclude that Cali is not atypical. In general we can expect that the larger the city, the higher the income, and the lower the transportation costs (Mills and Tan 1978), the lower is \( g \). This also implies that \( g \) depends on the age of the city (Harrison and Kain 1974). Older cities were built when intracity transportation costs were high and therefore the central cities were very dense. Consequently they had very high land values in the center. This pattern tended to persist over time. We can therefore expect that the fast-growing cities in Latin America would have relatively flatter density gradients.
Table 14-4
Population-Density Patterns in Bogotá and Cali, 1964-1978

<table>
<thead>
<tr>
<th></th>
<th>Population (thousands)</th>
<th>N</th>
<th>Actualb</th>
<th>Estimate 1c (thousands/sq.km.)</th>
<th>Estimate 2d</th>
<th>g</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bogotá</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964</td>
<td>1,730</td>
<td>292</td>
<td>22</td>
<td>23</td>
<td>(20)</td>
<td>-0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>1973</td>
<td>2,878</td>
<td>453</td>
<td>18</td>
<td>27</td>
<td>(10)</td>
<td>-0.15</td>
<td>0.22</td>
</tr>
<tr>
<td>1978</td>
<td>3,500</td>
<td>465</td>
<td>17</td>
<td>24</td>
<td>(10)</td>
<td>-0.12</td>
<td>0.19</td>
</tr>
<tr>
<td><strong>Cali</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964</td>
<td>640</td>
<td>131</td>
<td>21</td>
<td>39</td>
<td>(17)</td>
<td>-0.51</td>
<td>0.21</td>
</tr>
<tr>
<td>1973</td>
<td>930</td>
<td>195</td>
<td>16</td>
<td>24</td>
<td>(11)</td>
<td>-0.44</td>
<td>0.09</td>
</tr>
<tr>
<td>1978</td>
<td>1,100</td>
<td>193</td>
<td>16</td>
<td>29</td>
<td>(11)</td>
<td>-0.25</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Sources: Bogotá barrio population data from City Study files. Cali barrio population data from Tabares (1979).

Note: Equation estimated was $D_x = D_o e^{-gx}$ where $D_x$ is population density in people per square kilometer at distance $x$ in kilometers and $D_o$ is estimated population density at CBD.

*a* Number of data points in regressions.

*b* Residential population density for central business district (CBD).

*c* Estimate of $D_o$ from equation in note.

*d* Estimate of $D_o$ from $D_x = D_o e^{(fx_1 + x_2^2)}$. Other results not reported here.

*e* All estimates significant at the 0.01 level.
Table 14-5
Land-Value Patterns in Bogotá and Cali
(Prices in 1978 Col. pesos per m² and distances in kilometers)

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (thousands)</th>
<th>Actual(^b)</th>
<th>Estimate 1(^c)</th>
<th>Estimate 2(^d)</th>
<th>(h)(^e)</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bogotá</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>38</td>
<td>6,300</td>
<td>2,400</td>
<td></td>
<td>-0.18</td>
<td>0.56</td>
</tr>
<tr>
<td>1965</td>
<td>38</td>
<td>5,600</td>
<td>2,500</td>
<td>(2,470)</td>
<td>-0.15</td>
<td>0.55</td>
</tr>
<tr>
<td>1973</td>
<td>38</td>
<td>5,500</td>
<td>1,900</td>
<td>(2,290)</td>
<td>-0.08</td>
<td>0.39</td>
</tr>
<tr>
<td>1977</td>
<td>38</td>
<td>4,300</td>
<td>1,760</td>
<td>(2,240)</td>
<td>-0.07</td>
<td>0.35</td>
</tr>
<tr>
<td>Cali</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>84</td>
<td>5,000</td>
<td>2,240</td>
<td></td>
<td>-0.55</td>
<td>0.44</td>
</tr>
<tr>
<td>1963</td>
<td>155</td>
<td>5,000</td>
<td>2,030</td>
<td>(4,700)</td>
<td>-0.51</td>
<td>0.41</td>
</tr>
<tr>
<td>1974</td>
<td>171</td>
<td>3,700</td>
<td>1,030</td>
<td>(2,130)</td>
<td>-0.25</td>
<td>0.30</td>
</tr>
<tr>
<td>1979</td>
<td>171</td>
<td>5,300</td>
<td>2,070</td>
<td>(4,950)</td>
<td>-0.23</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Sources: Mohan (1979); Tabares (1979); Villamizar (1980); Velasco and Mier (1980).

Note: Equation run was \(V_x = V_o e^{-hx}\) where \(V_x\) is price at distance \(x\) and \(P_o\) is estimated price at CBD.

\(^a\)Number of data points in regressions.

\(^b\)Approximate average for CBD. Highest observed values are about three times these values.

\(^c\)Estimate of \(V_o\) from equation in note.

\(^d\)Estimate of \(V_o\) from \(V_x = V_o e^{(h_1x + h_2x^2)}\). Other results not reported here.

\(^e\)All estimates significant at the 0.01 level.
Case Study of Bogotá and Cali

Now we observe the estimates for \( D_o \): the hypothetical density at the center of the city. Column 4 gives the estimated densities in thousands per square kilometer. Column 3 gives actual observed densities. Note that central densities have remained relatively constant with a small observed decline, a phenomenon at least consistent with the behavior of land values in Bogotá. The estimated values are consistently higher. The CBD contains a large proportion of commercial economic activity and a relatively small residential population. It is therefore to be expected that estimated \( D_o \) would be higher than the actual.

Now consider table 14-5, which gives comparable land-value patterns for Bogotá and Cali. Once again, the estimates for land-value gradients decline with time in both the cities, as expected, and those for Cali are steeper than those for Bogotá. The comparability with the density gradients is remarkable (table 14-6). The estimated patterns are brought together and graphed in figure 14-6, where their comparability is evident. Recalling our simple model, we would expect land-value gradients to be similar to density gradients. Furthermore, they are consistently lower than the density gradients, as has been theorized (Mills and Song 1979, p. 109). A comparison of estimated \( V_o \) (land value at the center of the city) with actual \( V_o \) reveals that our estimates are consistently lower than the actual values. This implies that the gradient of the curve should be much steeper at the center of the city than we have estimated. Because of the high concentration of economic activity at the center, we can expect the land values to be determined much more by the employment density than by the residential density. Employment density falls rapidly from the center, and it is therefore quite plausible that land values will exhibit a similar decline. Estimated \( V_o \) therefore is quite likely to be lower than this central peak.

This brings us to a minor revision of the land-value and population-density functions. We have observed that the estimated densities were consistently higher for the CBD than the actual densities while land values are consistently lower. Indeed what we would expect is for residential densities to increase somewhat from the CBD and then decline, while land values should decline rapidly from the city center and then slow down. We have therefore attempted to fit quadratic exponential functions to the data:

### Table 14-6
Changes in Density and Land Value for Bogotá and Cali

<table>
<thead>
<tr>
<th></th>
<th>Bogotá</th>
<th></th>
<th>Cali</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Land Value</td>
<td>Density</td>
<td>Land Value</td>
<td>Density</td>
</tr>
<tr>
<td>1964</td>
<td>-0.15</td>
<td>-0.18</td>
<td>-0.51</td>
<td>-0.51</td>
</tr>
<tr>
<td>1972</td>
<td>-0.08</td>
<td>-0.15</td>
<td>-0.25</td>
<td>-0.44</td>
</tr>
<tr>
<td>1978</td>
<td>-0.07</td>
<td>-0.12</td>
<td>-0.23</td>
<td>-0.25</td>
</tr>
</tbody>
</table>
Figure 14-6. Changing Urban Structure of Bogotá and Cali, 1964-1978

\[ D_x = D_o e^{(g_1 x + g_2 x^2)} \]  
\[ V_x = V_o e^{(h_1 x + h_2 x^2)} \]

With \( g_1 \) positive and \( g_2 \) negative, the shape of the curve is as suggested above for the density (figure 14-7), while for land values \( h_1 \) is negative and \( h_2 \) is positive, which gives a rapidly declining curve, illustrated in figure 14-8).
The signs of the estimated coefficients are consistent with these conditions. The quality of statistical fit improves in all cases, implying that the quadratic functions are better approximations to the actual pattern. 2

In particular, note column 5 in tables 14-4 and 14-5. The estimates of $D_o$ and $V_o$ from the quadratic functions are somewhat closer to the actuals.

Therefore the land-value surfaces of Bogotá and Cali have evolved about as we would expect within the context of a very simple urban model. Land values have been highest at the CBD but have remained at a constant level in real terms over at least the past fifteen years. They have increased faster as one moves out from the city center and very much in accordance with the accretion of population that has occurred in successive outer layers of the city. The increases in real terms have been modest. Bogotá and Cali do not display a chaotic land market in this sense. If anything, the behavior of the land-price surface and of population densities is a bit too regular. Both density gradients and land-value gradients have flattened, but we must not be too hasty to conclude that these cities have decentralized in the sense of central cities losing population. It is important to note that among large European cities, this process of decentralization is of long standing. The population of central London reached its peak in 1930-1940, Paris in 1920,
Vienna in 1910, and Rotterdam, Zürich, Hamburg, Glasgow, and Amsterdam in 1950-1960 (Mitchell 1978, p. 12). All have declined since those dates, but with increasing suburban populations. To the extent that people congregate to improve economic opportunities for themselves and thereby impart higher values to land, we need to understand these processes better. With low transportation costs (despite the energy crisis) and changing manufacturing technology, there is reason to believe that manufacturing jobs are indeed increasingly moving to peripheral locations (Lee 1979), although the volume of these jobs has not yet been large enough to reduce the importance of the city center as a commercial center. We can expect greater movement of commerce and service jobs with manufacturing in the future with the obvious consequences on access characteristics of peripheral locations.

The Smoothly Evolving Land-Value Surface: Some Wrinkles

So far we have treated the city in a relatively simple manner. The measurement of land-value and population-density gradients assumes that the city is symmetrical around the city center. In the cases of Bogotá and Cali, each

Source: Tables 14-4 and 14-5.

Figure 14-8. 1979 Land Value Gradient, Cali
city is constrained by mountains on one side, and the cities are therefore semicircular, with the city center roughly at the center of the semicircle. The cities are not, however, symmetrical otherwise. If we divide each city into approximate pie slices or radial sectors, as shown in figures 14-9 and 14-10, we observe distinct differences among the sectors (see Mohan 1979 and Terrell 1980). In Bogotá in particular, the north (sectors 7 and 8) can be characterized as rich and the south (sectors 2 and 3) as poor. Sectors 4 and 5 comprise the industrial zone or corridor. In Cali the picture is more mixed, but, broadly, the western part of the city (sectors 2, 6, and 7) is richer than the eastern part (sectors 3, 4, and 5). In general, jobs exceed the number of resident workers in the rich sectors, and the converse is true in the poorer sectors. As we might expect, the density of population is higher in the poor as opposed to the rich sectors. The question now is how these differences in land use in different sectors of the city affect population-density patterns and land values. Do density patterns and land-value gradients hold up if calculated for different sectors of the two cities?

In order to illustrate the patterns, we include computer maps of land value and population density in Bogotá, which show at a glance where population densities and land values are high: the darker the shading, the higher the density or land value. Contrary to our expectations the two maps do not appear to be too similar. (See figures 14-11 and 14-12). It is true in general, though, that in any direction from the CBD, the darker shading is nearer the center, with lighter and lighter shades as we move toward the edge of the city. Within the same ring (or same distance from the CBD) it is clear that both densities and land values are quite heterogeneous. Indeed, the denser areas appear to have lower land values than the less-dense areas within the same ring. How is the paradox to be resolved?

Until now we have concentrated on the access characteristics of land as determinants of land value and have been using distance from the CBD and residential densities as proxies for access characteristics. Now we must enrich our notions of access characteristics. In addition we have to consider the other determinants of land value mentioned in our simple model: neighborhood quality and intrinsic quality of land. By access characteristics we mean the proximity of land parcels to economic opportunities. We had hypothesized that large or dense agglomerations of people were instrumental in increasing these economic opportunities and that this was the reason for the clustering of population near the city center. Thus a concentration of economic activity in the center produced relatively high population densities and consequently high land values, both of which then declined with distance.

The observation that the rich live in some parts of the city and the poor in others leads us to revise some of these ideas. That more jobs are located in rich sectors means that those sectors are economically more attractive
Figure 14-9. Bogotá Sector System
and firms have a greater tendency to locate there. Thus the lower densities of those areas are being more than enhanced by purchasing power. As a proxy for access characteristics, we have to employ the notion of purchasing power. The product of population and mean income is probably not a good measure of these access characteristics since the requirements of a large number of poor people do not aggregate; each household has meager demands so poor sectors can support only a limited number of economic activities. Consequently the rich neighborhoods have an excess of jobs over the resident labor force, and the access characteristics of these neighborhoods are not adequately measured by population densities. In addition we can expect the infrastructure provisions (such as roads, lighting, water supply, and sewerage) to be better in high-income neighborhoods, and therefore both neighborhood quality and intrinsic site characteristics are more desirable. All of these factors combine to produce somewhat higher land values than the population densities would lead us to expect in relatively rich neighborhoods.

We estimated the population-density and land-value gradients for each sector in Bogotá and Cali and emerged with striking results. Table 14-7 gives the estimates of these gradients along with the $R^2$ for each estimated regression. The general result is that the exponential function is still a good
Table 14-7  
Land-Value and Density Gradients in Cali and Bogotá by Sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>Household Mean Income Indexa</th>
<th>Land Valueb</th>
<th>Density</th>
<th>Household Mean Income Indexb</th>
<th>Land Valuea</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>g2</td>
<td>R2</td>
<td>h2</td>
<td>R2</td>
<td>g2</td>
</tr>
<tr>
<td>Sector 1 (CBD)</td>
<td>163</td>
<td>-0.42</td>
<td>0.69</td>
<td>-0.13*</td>
<td>0.00</td>
<td>61</td>
</tr>
<tr>
<td>Sector 2</td>
<td>212</td>
<td>-0.45</td>
<td>0.73</td>
<td>-0.10*</td>
<td>0.00</td>
<td>52</td>
</tr>
<tr>
<td>Sector 3</td>
<td>84</td>
<td>-0.42</td>
<td>0.69</td>
<td>+0.13</td>
<td>0.11</td>
<td>74</td>
</tr>
<tr>
<td>Sector 4</td>
<td>58</td>
<td>-0.55</td>
<td>0.77</td>
<td>+0.07*</td>
<td>0.02</td>
<td>96</td>
</tr>
<tr>
<td>Sector 5</td>
<td>82</td>
<td>-0.21</td>
<td>0.41</td>
<td>-0.26</td>
<td>0.16</td>
<td>103</td>
</tr>
<tr>
<td>Sector 6</td>
<td>125</td>
<td>-0.21</td>
<td>0.41</td>
<td>-0.26</td>
<td>0.16</td>
<td>97</td>
</tr>
<tr>
<td>Sector 7</td>
<td>219</td>
<td>-0.86</td>
<td>0.59</td>
<td>-0.13*</td>
<td>0.05</td>
<td>122</td>
</tr>
<tr>
<td>Sector 8</td>
<td>236</td>
<td>-0.07</td>
<td>0.55</td>
<td>-0.14</td>
<td>0.32</td>
<td>61</td>
</tr>
</tbody>
</table>

Source: Velasco and Mier (1980); Tabares (1979); Pachón (1980); Villamizar (1980); City Study barrio file.

*aPercentage of mean household income for the city.

bFor 1979.

cAll coefficients significant at the 0.01 level except those marked with asterisk.

dFor 1975-1978.
Case Study of Bogotá and Cali

approximation to the pattern of land values for each sector. The population densities, however, do not do so well. The estimated density gradients are not significantly different from zero in a number of sectors. Indeed, in Cali, sectors 4 and 5 exhibit mildly positive gradients, and in Bogotá the density gradients are low or insignificant for sectors 2, 3, 5, and 6. What is common among these sectors is relatively low mean income. Note that land-value gradients are not significantly different from others in these sectors. That the population density does not vary appreciably with distance in the south of Bogotá is also obvious from figure 14-11.

To understand these phenomena, we need to delve further into the role of land values and their effect on urban structure. Gregory Ingram has emphasized the role of land as a factor of production. When land values are high, capital is substituted more for land, and the result is the construction of taller buildings. We can therefore expect to observe, on average, taller buildings in city centers and in zones where land prices are high. As land prices increase, single-family homes are replaced by multifamily apartments, and residential densities rise. While residential densities rise per unit of land area, living space per person does not necessarily decrease. These options are not open to the poor, however.

We observed previously that land prices rose more in the outer rings than in the inner ones, as expected. A further analysis revealed that the rates of price increases were no higher in the rich areas as compared with the poor (Villamizar 1980). In Bogotá, the rate of increase (adjusted for inflation) in the rich sector, sector 8, was about 2.5 percent per year between 1955 and 1977 and about 4 to 7 percent per year in the poorer sectors (2, 3, and 6). The price levels, however, were consistently lower in the poor areas. These data indicate that, although each land parcel is nonsubstitutive to some extent, there is a city-wide land market that is functioning. While land prices in poor areas continue to be lower than in richer areas, there is a catch-up phenomenon so that prices of land parcels equidistant from the city center are not too dissimilar. The natural result of this phenomenon is that while the rich substitute for land with capital, the poor substitute for land by crowding.

Figure 14-13 illustrates the structure of Bogotá by average number of floors in each zone. We can observe that much of the housing in Bogotá still has fewer than two floors, that the number of floors declines rapidly from the CBD, and that the northern part of the city, the richer sector 8, has taller buildings than other areas of the city. Table 14-8 gives other housing characteristics by residential rings and sectors. The average number of floors declines systematically by ring. It is also of interest that the average age of dwellings declines and that the proportion of single-family homes increases with distance. These patterns are very much in accordance with our expectations: capital is being substituted for land in the shape of taller
Figure 14.13: Average Number of Floors in Bogotá, 1978
buildings in the inner rings; the city has grown by accretion on its edges, and therefore the outer rings have newer houses; and apartment buildings or semidetached houses are replacing single-family houses as prices increase nearer the CBD. Land prices are performing their function well, and the housing market seems to be responding as expected.

Now examine column 5 in table 14-8. There is no clear pattern of average dwelling-unit space per person except that it is low in the CBD. We would expect that living space per person would be larger in the outer rings because people would be trading space for higher transportation costs. If we now look at the sectoral pattern, it is clear that the poorest sectors (2 and 3) in the south have much less living space per person than the northern rich sectors. Thus the poor are substituting crowding for land, and the rich are substituting capital.

We now begin to understand why the land-value gradients hold up even when the cities are disaggregated into sectors and the density gradients do not. The functioning of the land market results in land values being not too different at similar distances from the center. The rich sectors have higher land values because of better employment opportunities as well as better neighborhood quality and infrastructure quality. The land values being

---

**Table 14-8**

Spatial Pattern of Housing in Bogotá, 1978

<table>
<thead>
<tr>
<th></th>
<th>Mean Household Income Index</th>
<th>% Single-Family Unit</th>
<th>Average Age of Dwelling Unit (years)</th>
<th>Average Number of Floors</th>
<th>Average Dwelling Unit Space per Person (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring 1</td>
<td>62</td>
<td>39</td>
<td>16</td>
<td>7.1</td>
<td>14</td>
</tr>
<tr>
<td>Ring 2</td>
<td>116</td>
<td>57</td>
<td>21</td>
<td>3.5</td>
<td>23</td>
</tr>
<tr>
<td>Ring 3</td>
<td>124</td>
<td>74</td>
<td>16</td>
<td>2.8</td>
<td>30</td>
</tr>
<tr>
<td>Ring 4</td>
<td>112</td>
<td>86</td>
<td>12</td>
<td>1.7</td>
<td>23</td>
</tr>
<tr>
<td>Ring 5</td>
<td>82</td>
<td>95</td>
<td>9</td>
<td>1.8</td>
<td>18</td>
</tr>
<tr>
<td>Ring 6</td>
<td>122</td>
<td>100</td>
<td>8</td>
<td>1.5</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>85</td>
<td>12</td>
<td>2.1</td>
<td>21</td>
</tr>
<tr>
<td>Sector 1</td>
<td>61</td>
<td>39</td>
<td>16</td>
<td>7.1</td>
<td>14</td>
</tr>
<tr>
<td>Sector 2</td>
<td>53</td>
<td>96</td>
<td>13</td>
<td>1.4</td>
<td>12</td>
</tr>
<tr>
<td>Sector 3</td>
<td>74</td>
<td>91</td>
<td>10</td>
<td>1.8</td>
<td>19</td>
</tr>
<tr>
<td>Sector 4</td>
<td>96</td>
<td>91</td>
<td>11</td>
<td>1.9</td>
<td>25</td>
</tr>
<tr>
<td>Sector 5</td>
<td>103</td>
<td>72</td>
<td>18</td>
<td>3.4</td>
<td>20</td>
</tr>
<tr>
<td>Sector 6</td>
<td>97</td>
<td>92</td>
<td>10</td>
<td>2.1</td>
<td>21</td>
</tr>
<tr>
<td>Sector 7</td>
<td>122</td>
<td>84</td>
<td>17</td>
<td>1.9</td>
<td>30</td>
</tr>
<tr>
<td>Sector 8</td>
<td>236</td>
<td>59</td>
<td>10</td>
<td>2.9</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>85</td>
<td>12</td>
<td>2.1</td>
<td>21</td>
</tr>
</tbody>
</table>

Source: Sungyong Kang (1980); Pachón (1980).
relatively regular, the poor have no choice but to substitute for land by
crowding. Even when they slide down the rent gradient and locate at the
periphery, they still have to live at high densities to compensate for the land
prices, which are similar to land prices in the rich suburbs. They cannot buy
more space by substituting capital for land since the housing would then be
too expensive. Note in table 14-8 that the average number of floors is 2.9 in
rich sector 8 and only 1.4 to 1.8 in the poor sectors 2 and 3. The result is that
we observe high population densities on the periphery of some parts of the ci-
ty and consequently there is virtually no measurable density gradient in those
sectors. The rich sectors still have a density gradient, and we can therefore
observe gradients for the city as a whole as well. Nonexistent density gra-
dients in some sectors of the city are consistent with relatively strong land-
value gradients. We have therefore resolved the paradox posed at the beginning
of this section. In so doing we also provide reason for caution in interpreting
similarities between city-wide population density and land gradients.

There is one other important aspect of land-value patterns meriting fur-
ther discussion. We have often alluded to the importance of the level of
economic activity in a zone to the determination of land values. We have
focused on the predominance of the CBD as the economic hub of the city. As
a large city grows, however, it acquires many new competing commercial
centers, which began to rival the old CBD. These alternative (or additional)
economic centers in turn are strong motivating forces for residential popula-
tion to decentralize as well.

We examine this process by looking at the evolving land-value peaks
along key urban corridors in Bogotá (Villamizar 1980). Figure 14-14 gives a
pictorial representation of this process. The street system of Bogotá is in a
systematic grid conforming to old Spanish urban-planning tradition. Car-
neras (avenues) run north to south and are numbered in ascending order away
from the mountains toward the west. Calles (streets) run east-west and are
numbered from the CBD in ascending order toward both north and south.
Figure 14-14 gives the trend of land prices over time at fixed ranges of key cor-
rridors in Bogotá. As an example, note the pattern of carrera 7a in the bottom
right-hand corner of figure 14-14. Carrera 7a runs through the CBD of
Bogotá, which is around calles 7 to 20. Observe that the prices around the old
core—between calles 7 and 17—have been decreasing secularly, while those in
the range of calles 27 through 45 have been tending to increase. The mid-
range calles (14-26) have been relatively stable. The commercial center of
Bogotá has been tending to move northward (see Wiesner 1980). Thus the
position of the region between calles 20 and 45 has improved relative to the
old core. Observe also the land-value peaks around calles 46 through 60 on
carreras 13 and 14. This is the Chapinero area, which started to develop in the
1950s and has since been an important commercial and shopping center, com-
petitive with the CBD.
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Source: Reproduced from Villamizar (1980) and data from "The Evolution of Land Values in the Context of Rapid Urban Growth: A Case Study of Bogotá and Cali, Colombia," @ Rakesh Mohan and Rodrigo Villamizar (Bogotá, Colombia: Corporacion Centro Regional de Poblacion).

Note: $C =$ Calle; $K =$ Carrera.

**Figure 14-14.** Evolution of Land Prices Along Main Radial Corridors, Bogotá
This detailed analysis along ridges of the land-value surface reveals small hills in accordance with the access characteristics that go with higher levels of economic activity in the developing subcenters of a rapidly growing city. Because of such developments, the gradient of land prices decreases as a city grows. The relative importance of the CBD declines, and secondary gradients develop around the subcenters. We therefore confirm the fourth result from our simple urban model: as a city grows, the smooth land-price surface centered around the CBD develops wrinkles as ridges, valleys, and small hills around the new subcenters that are observed in Bogotá.

Mills and Song (1979) found that in Korean cities, commercial land values were always higher than residential land values in the CBD, as well as in the rest of the city at equidistant points from the center. The evidence we have presented is consistent with their findings. Indeed, at equal distances from the CBD, the proportion of area covered by commercial activity in any neighborhood is a good predictor of the level of land values in that area. These results are quite consistent with our expectations about access characteristics of neighborhoods and, moreover, with the observed higher land values in richer areas of the city. Commercial activity locates itself in the rich areas of the city.

Rising Land Prices: Should We Worry?

A detailed examination of land-value and density patterns in Bogotá and Cali has revealed that the evolution of these patterns has been neither chaotic nor unpredictable. Land values have responded to the rapid growth of these cities much as they might be expected to in a market economy. Growth in land values has been the greatest at the periphery of these cities and least at the center. Furthermore, land values in poor areas have increased as fast as, if not faster than, those in rich areas.

These results are somewhat surprising in the presence of a widespread impression in Colombia, as in other developing countries, that land prices in cities have been growing in recent times at undesirably high and unwarranted rates. The paradox of our results is that these impressions are not necessarily misinformed. People tend to focus on the growing or developing parts of cities. It is undeniably true that these areas experience the greatest magnitude of change, as they should in a market economy. It is also true that many people make large windfall gains in these areas. The issue to worry about, then, is income distribution. Does the land market operate in such a way that it widens the already high levels of inequality that exist in many poor countries?

The answer to this question will depend on the specific circumstances in every city or country. We have little information on the concentration
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of ownership of land in these cities. Ingram has presented some information on the concentration of developers in the legal housing market in Bogotá. He concluded that there does not appear to be a high level of concentration in this market. Elsewhere (Carroll 1980) there is also evidence that the illegal housing market is not concentrated. The process of development at the edge of a city, where the largest rates of price increases are observed, appears to go through a number of stages. When land is in agricultural use, we naturally expect plots of land to be much larger than characteristic urban plots. In Bogotá and Cali, many tracts of land at the edges of the two cities were certainly very large. In such situations there is an element of local monopoly power, but the land offer price cannot be too much out of line as compared with other comparable areas; otherwise the developers would move there. The norm in Bogotá is that the original owners sell to developers (illegal or otherwise), who then subdivide the tracts and sell to individuals for housing. Alan Carroll has shown that there is little evidence that the intermediary developers make excess profits as compared with usual rates of return on investment in Colombia. He does show, however, that some do make very large profits; these are, perhaps, the more-visible ones. Despite the windfall gains that occur at various stages of the development of peripheral locations around a city, it is very likely that the process of subdivision leads to much more equality in the ownership of land. To the extent that the new owners are relatively poor and that the process of a city's growth is such that it is accompanied by large land-value increases at the periphery, there is a high likelihood that much of this increase accrues to the poor. This may be the case despite large windfall gains that may accrue to the original owners.

These ideas are somewhat speculative, but we do have adequate information that is at least suggestive in these directions. Illegal housing activity consistently appears to account for about 60 percent of all residential housing construction in Bogotá (Kang 1980); land values have risen as much (or more) in poor areas as in rich areas; the proportion of owner-occupied housing increases as one moves toward the periphery; while the poorest do not in general live on the periphery, the outer rings are somewhat poorer on average. Consequently, urban land is probably one of the few assets that the poor have relatively better access to.

These remarks are not meant to imply that all is well in Bogotá and Cali, but we do imply that things may not be as bad in the land market as is often supposed. Indeed our evidence on density patterns indicates that all is not well. The extremely high densities in poor areas, especially peripheral areas, mean that the only way that large numbers of the poor can afford to live in the city is under extremely crowded conditions. Health problems result from such crowding, which is often accompanied by poor infrastructure provision. The choices in these situations are difficult. The more infrastructure that is provided, the higher the resulting price of land; and conse-
quently higher density (crowding) would result. On the other hand, without infrastructure provision, health problems would increase, despite less crowding. Much higher densities were observed in American and European cities before the advent of mechanized transportation, and their health problems were also worse. In the early stages of industrialization, the net natural-growth rates of European cities were often negative. They were able to grow only because of high in-migration rates (Toynbee 1970; Weber 1967). Because of general sanitary improvements, conditions in cities in poor countries are clearly not as bad, but we should be alert to the dangers of overcrowding. In that sense, we should worry about high land prices, but the source of our concern should be clear. If it is the access of the poor to shelter that we are concerned about, policy measures should address these problems directly. It may be that subsidized or free access to land in the nature of squatters’ rights is the best solution to this problem. It should then be recognized as such, and the opportunity cost of that land should then be viewed as the cost of such a policy. Cognizance should also be taken of the price of land as a signal for the allocation of resources.

This is not the place for a discussion of appropriate land policies. Our objective has been to provide an understanding of the role of land values in the growth of cities by providing evidence from two rapidly growing cities in Colombia. We hope that similar empirical work can be accomplished in other cities so that appropriate urban land policies can be designed. Objectives of these policies should be made clear. Are urban land policies concerned with appropriate urban structure, with providing access to housing for the poor, or with achieving a better income distribution? What must be remembered is that land-price controls can obscure the value of land, but they cannot change it.

Acknowledgments

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Notes

1. The data for Bogotá for the last period are an average for 1975-1977, while those for Cali are for 1979. If it is true, as some believe, that there has been an inflationary spurt in land values in the last two years, absolute values in Bogotá would not be less than those in Cali.

2. We do not present the detailed results here. Note that the quadratic functions are not without their own problems. The estimated curve in figure 14-8 for land values starts rising after 6 kilometers, which is not borne out by the data.

References


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Moderator

William Doebele: Academics have not done a great deal of research on land markets, so I think it is fascinating that Dr. Mohan mentioned the use of brokers as a means of getting data very quickly. One of the characteristics of many developing countries is that one of the small occupations engaged in by thousands of people is the real estate business. This was very useful to us in some work we did in Korea. These brokers have a wealth of information about land prices. Sometimes you have to double-check them to make sure that the information is correct, but given the lack of systematic academic research, you might think about dealing with these people who deal with land every day and see if you can’t very quickly get some data and then use other means of checking them.

If I understood correctly, the peak growth in Bogotá and Cali was in the 1950s and 1960s, and there has been some slowing recently. There were also some comments that the smaller cities are now growing more rapidly in Colombia than the larger ones. We have here phenomena in the process of change, and we are beginning to get some data about them. It is certainly true that the pattern of urbanization is changing and that the extrapolations that we have believed in for about twenty years may no longer be the case.
No. 274. Ron Duncan and Ernst Lutz, "Penetration of Industrial Country Markets by Agricultural Products from Developing Countries," *World Development*


No. 276. Sweder van Wijnbergen, "Interest Rate Management in LDCs," *Journal of Monetary Economics*


No. 278. Oli Havrylyshyn and Martin Wolf, "Recent Trends in Trade among Developing Countries," *European Economic Review*


No. 280. Walter Schaefer-Kehnert and John D. Von Pischke, "Agricultural Credit Policy in Developing Countries," translated from *Handbuch der Landwirtschaft und Ernährung in den Entwicklungsländern* (includes original German text)

No. 281. Bela Balassa, "Trade Policy in Mexico," *World Development*

No. 281a. Bela Balassa, "La política de comercio exterior de México," *Comercio Exterior*


No. 283. Anne O. Krueger, "Trade Policies in Developing Countries," *Handbook of International Economics*


No. 288. Hollis B. Chenery, "Interaction between Theory and Observation in Development," *World Development*


No. 291. Danny M. Leipziger, "Lending versus Giving: The Economics of Foreign Assistance," *World Development*
